ICB-2500

3344

US Model
Canadian Model

CITIZENS BAND TRANSCEIVER

SPECIFICATIONS

GENERAL

Operating Frequency: Within the 26.965 – 27.405 MHz band
40 channels full coverage (on Page 114)

Antenna: External Antenna Connector
coaxial connector type SO-239

Communication System: Push-to-talk system

Power Requirement: 13.8 V dc (from positive or negative grounded 12V car battery)

Dimensions: 209 (w) x 64 (h) x 256 (d) mm
8 1/4 (w) x 2 1/2 (h) x 10 1/8 (d) inches
including projecting parts and controls

Weight: 2.5 kg, 5 lb 8 oz

TRANSMITTING SECTION

Transmitting Power: AM: 4 W
USB/LSB: 12 W (PEP)

Frequency Tolerance: Short time stability
- ±0.0005 % (−10°C — +60°C)
- ±0.0015 % (−30°C — +60°C)

Circuitry: P.L.L. synthesizer with quartz crystal controlled circuit

Modulation: AM: Collector modulation in final and driver stage
USB/LSB: Balanced modulation

Current Drain: 1.7 A without modulation in AM operation

Carrier Suppression: More than 45 dB

Sideband Suppression: More than 45 dB

Spurious Response: More than 65 dB

RECEIVING SECTION

Circuitry: P.L.L. synthesizer with quartz crystal controlled circuit
Dual conversion superheterodyne

Maximum Sensitivity: Less than 0.15 μV, at S/N = 6 dB (SSB)
Less than 0.45 μV, at S/N = 6 dB (AM)

Selectivity: −6 dB at 2.1 kHz (SSB)
−70 dB at 5.0 kHz (SSB)
−70 dB at 10 kHz (AM)

Intermediate Frequency: 1 st: 10.695 MHz
2 nd: 455 kHz

Audio Power Output: 1.5 W (SSB/AM) at 10 % distortion
4.0 W (PA)

Current Drain: 0.6 A at zero signal in SSB operation

Speaker: 9.2 cm (3 5/8 inches) dia. 8 ohms

NOTICE

REPAIR AND ADJUSTMENTS (OTHER THAN THE SPECIFIED OPERATING ADJUSTMENT) BY PERSONS NOT HOLDING A VALID FCC FIRST OR SECOND CLASS RADIOTELEPHONE OPERATORS LICENSE IS ILLEGAL. USE OF REPLACEMENT PARTS OTHER THAN THE EXACT SONY REPLACEMENT PARTS APPROVED FOR USE IN THIS DEVICE IS ILLEGAL.

SONY®

SERVICE MANUAL

3344

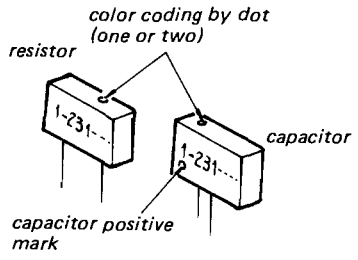
SPECIAL COMPONENS FOR PHASE SHIFT NETWORK

This set uses a total of twelve special components in the PSN circuit of the SSB generator section. If even one of these components is defective, all twelve components must be replaced. When replacing these components, confirm that the colored dot at the top of the components is the same color (matched pair classification). Individual data are shown in the below table.

After the 12-piece kit has been received, confirm that the dots of the twelve components are the same color. Next, check the part number printed on the face of each of the twelve components against the below table and confirm the reference number of the each component.

Special Components

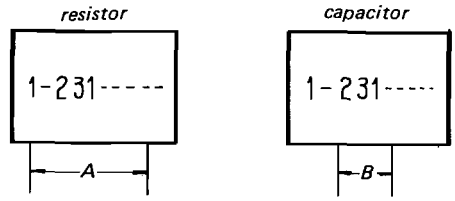
Center of allowable	Numbers of dots	Color of dots	Part No. of 12-piece kit
−2.75 %	1	brown	9-831-024-11
−2.25 %	1	red	
−1.75 %	1	orange	
−1.25 %	1	yellow	
−0.75 %	1	green	
−0.25 %	1	blue	
+0.25 %	1	violet	
+0.75 %	1	gray	
+1.25 %	1	white	
+1.75 %	2	brown and white	
+2.25 %	2	brown and brown	
+2.75 %	2	brown and red	



Detail of 12-piece kit

Part No.	Ref. No.	Description
1-231-318-21	CR402A	190.2 kΩ
	CR402B	1,700 pF
1-231-319-21	CR401A	53.4 kΩ
	CR401B	6,000 pF
1-231-320-21	CR403A	56.3 kΩ
	CR403B	1,700 pF
1-231-321-21	CR404A	15.8 kΩ
	CR404B	6,000 pF
1-231-322-21	CR405A	40.6 kΩ
	CR405B	6,000 pF
1-231-323-21	CR406A	74 kΩ
	CR406B	1,700 pF

Note: • One part number indicates two components which are a resistor and a capacitor. When installing them, confirm separation between the leads of the component.



A is longer than B.

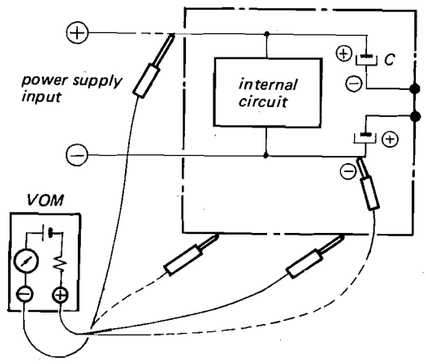
- Some capacitors have the same capacitance, but they are unexchangeable. Be sure to use the components as shown in the above table.

CAUTION

When ordering the special components, use the part kit number of 9-831-024-11. They can not be ordered by the part number of 1-231-□□□-□□.

CAUTION ON REPAIRING

1. Do not short-circuit B+ and ground patterns. This set requires a large-current power supply of 3A for testing and repairing. If the B+ bus is shorted to the ground, B+ bus may be burned out. Be most careful when checking the component side of the circuit board, because there are more than ten B+ patterns on the component sides.
2. Do not short-circuit B+ (T) and B+ (R) lines. If B+ (T) and B+ (R) lines are shorted, the two B+ leaking transistors Q454 and Q455 will be damaged. Also the receiver's first stage FET will be damaged from receiving transmitter's output power at its gate.
3. Before starting and at the completion (completely cased) of the repairing, check with a VOM that there are no dc connections between the positive terminal of the power supply input and case, and between the negative terminal of the power supply input and case. Many electrolytic capacitors are connected between the power supply leads (positive and negative) and case. So connect the VOM as illustrated below. If the VOM leads are connected reversely, reversed voltage is applied to the electrolytic capacitor C, and it looses its polarities. In this condition, capacitor C becomes low resistance and checking of the set is impossible.

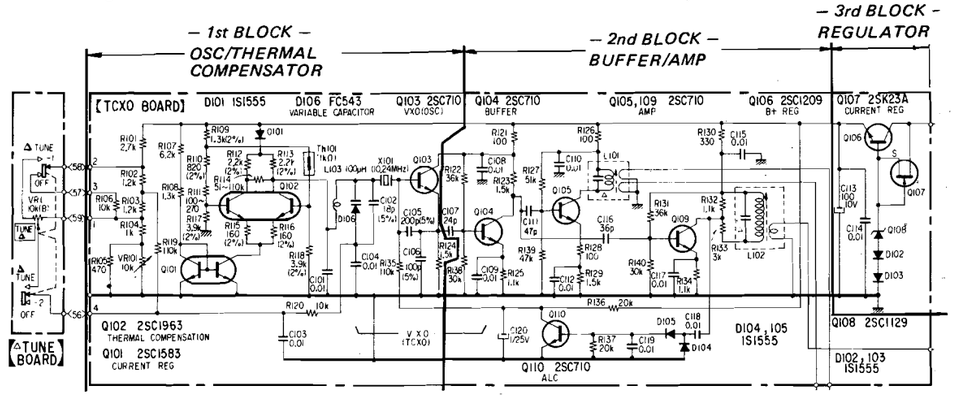


4. Electrolytic capacitors connected between the negative line of the internal circuit and frame should have its positive terminal connected to the frame. If not, the electrolytic capacitor will be damaged when the set is mounted in an automobile which has a positive-gound circuitry.
5. The cold side of the antenna is dc-connected to the case of the set. And the set does not damage if the hot side of the antenna is touched to the body of the automobile.

REPAIRING TCXO (VXO)

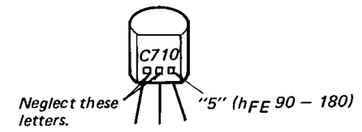
The TCXO is composed of three blocks. The first block contains the variable crystal oscillator and thermal compensator. The second block contains a buffer and amplifier. The third block contains B+ and current regulators.

The second block can be repaired. However, when the first and third blocks are defective, replace TCXO board completely. Only operation check can be made to these two blocks. Component replacements can be made only to the second block.



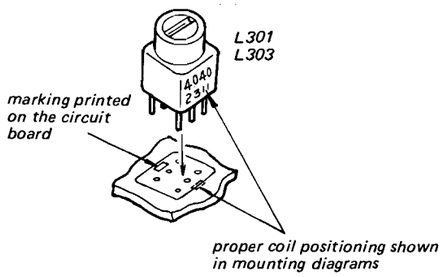
Note: 1. When checking the TCXO, depress Δ TUNE knob to turn off the Δ TUNE function. When Δ TUNE knob is pulled, the oscillator frequency is varied around 10.24 MHz by turning the Δ TUNE control.

2. Voltage readings shown in the diagrams are to be taken as only reference values because the operational characteristics of the first and second blocks are compensated dependent upon the reference voltage supplied by the third block.
3. When replacing transistors Q104, 105, 109 and 110 in the second block, use transistor 2SC710-15 which can be identified by following the illustration shown below.



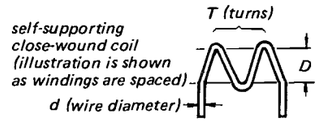
POSITIONING COILS L301 and L303

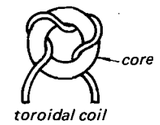
Mount L301 and L303 on the MA board as shown in the mounting diagrams. The mounting marks printed in white on the component side of the MA board are different from the mounting diagrams.



COIL TABLE OF TX AMP SECTION

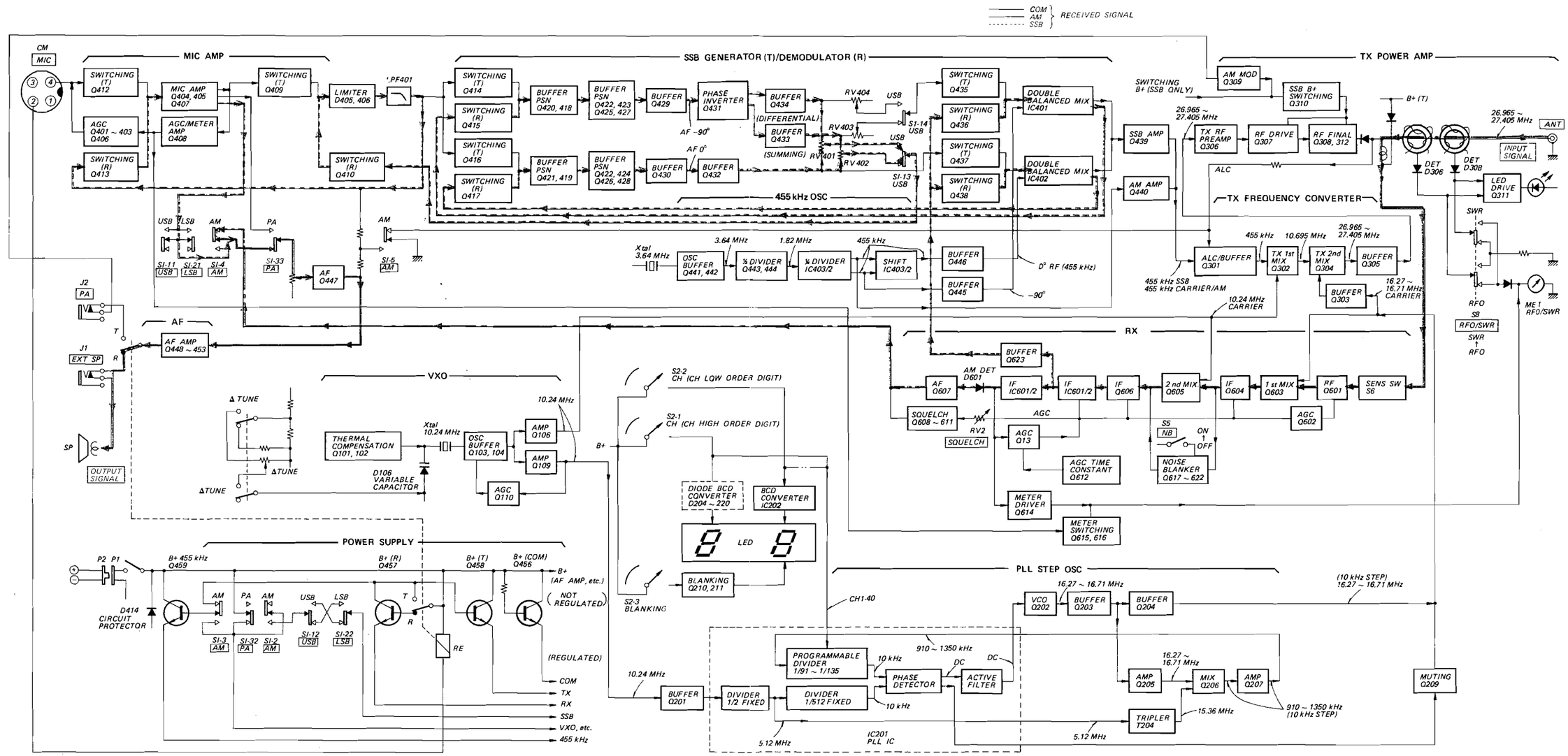
Ref. No.	Part No.	Indication	D (mm)	d (mm)	T (turns)	Winding
L307	1-420-867-00	–	4.0	0.6	9	close
L308	–	1R2 (1.2 μH)	–	–	–	–
L309	1-420-868-00	–	6.5	0.7	1.5	close
L310, 311	–	1R2 (1.2 μH)	–	–	–	–
L312, 313	1-420-869-00	–	4.5	0.6	6	close
L314, 315	–	100 (10 μH)	–	–	–	–
L316	1-420-864-00	–	5.0	0.6	9	close
L317	1-420-865-00	–	8.0	0.8	8	close
L318	1-420-866-00	–	8.0	0.8	7	close
L319, 320	1-459-193-00	–	–	0.35	2.5	toroidal





SECTION 1
OUTLINE

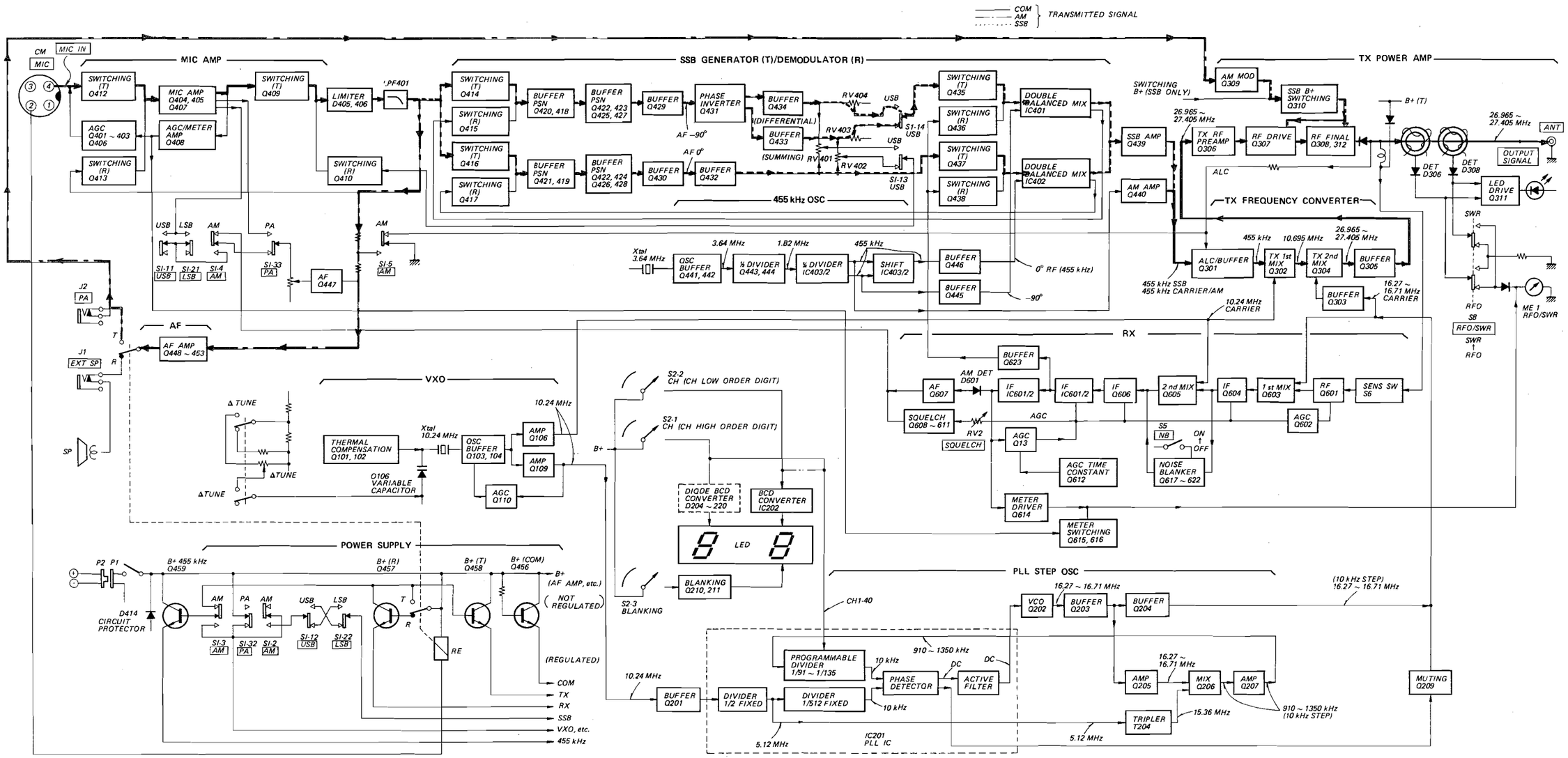
1-1. BLOCK DIAGRAM – Receiving Mode –



- **Abbreviation**

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
Δ Tune .. Delta Tune

1-2. BLOCK DIAGRAM – Transmitting Mode –



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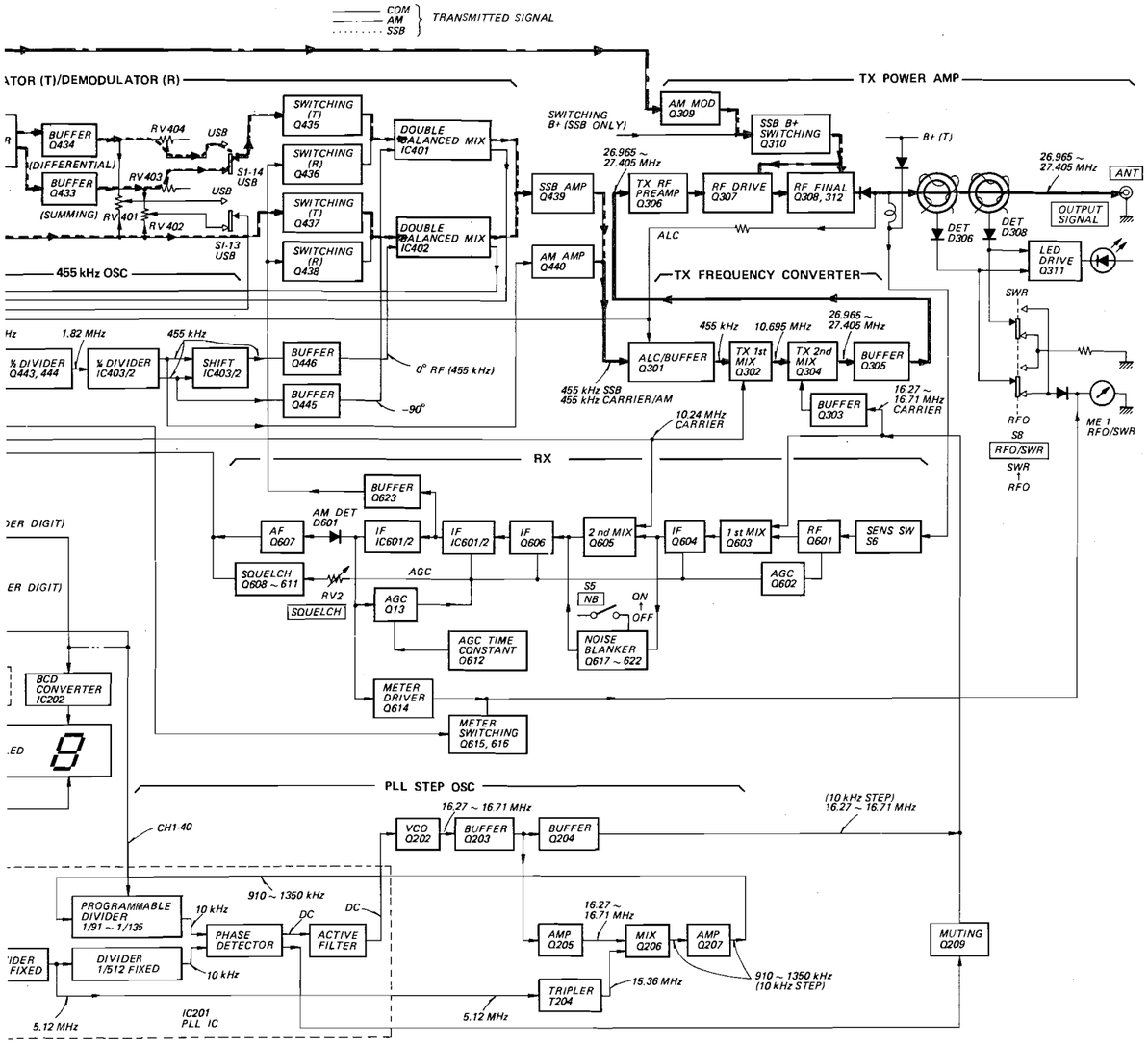


1. MIC AMP

Q401 – 413 constitute the MIC amp. Of these, Q404, 405 and 407 are amplifiers. Q409, 410, 412 and 413 are the transmitter/receiver switching gate. Q401 – 403, 408 and 406 are for AGC use. In order to stabilize the transmitting signal level through the RF section of the transmitter, ALC (Automatic Level Control) is applied to the straight RF amplifier from TX (transmitter) frequency converter. This stabilizes and maintains the level of the straight section and prevents splatter, but does not prevent excessive input at the SSB generator.

Consequently, the maximum voice level from the MIC input to the SSB generator must be established and must not be exceeded. This is accomplished by applying AGC to the MIC amplifier with Q401 – 403, 406 and 408. The MIC amplifier is also used for the PA (Public Address system), but in this time AGC is OFF.

The LPF (Low-Pass Filter) rejects frequencies over 2.2 kHz by 65 dB or more at 5 kHz. The LPF displays maximum performance when the load and signal source impedance are 1.2 kΩ.

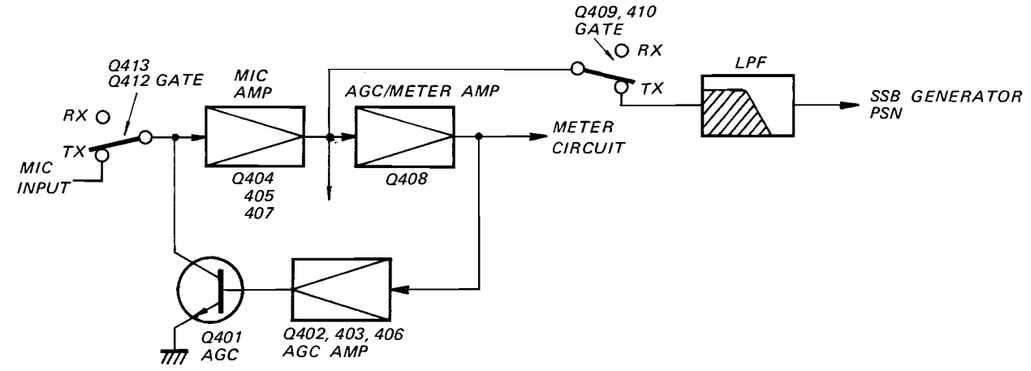


Fig. 1. Mic amp

2. SSB Generator

Q414 – 440, IC401 and 402 consistute a phasing type SSB generator, and Q441 – 446 and IC403 consistute the 455 kHz oscillator as a peripheral circuit of the SSB generator. Q414 – 440, IC401 and 402 are also used as the SSB demodulator during receiving operation. Transmitting operation is described first.

Two DSB (Double Side-Band) signals having reversed-phase are mixed and a single side-band is obtained by phase cancellation.

As shown in Fig. 2, if one of the sidebands of the DSB signal is shifted 180°, that DSB signal and a normal DSB signal are combined and the sideband signals having a 180° phase difference are cancelled. The 180° phase difference is attained by shifting the modulation signal 90° and a further the carrier (fc) 90°. The fc not required as output is suppressed by means of a balanced MOD (modulator).

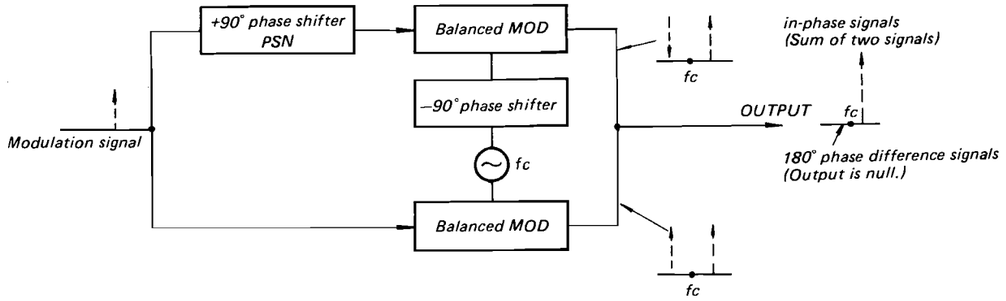


Fig. 2. Principles

(1) AF PSN (Audio Frequency Phase Shift Network)

The AF PSN is illustrated in Fig. 3. Since the phase cannot be linearly shifted for a wide frequency range, two sets of circuits which change the phase linearly relative to frequency response over a flat range are used. The constants of both circuits is selected so that they have a phase shift of 90°.

The most important factor at this PSN is the level and phase differences of both outputs. And to maintain these, RR401 – 404 are composite components paired and CR401 – 406 are special components. The level and phase related part considered in addition to these is the difference in the gain of the transistors of each part, but the effect of this is prevented as described below.

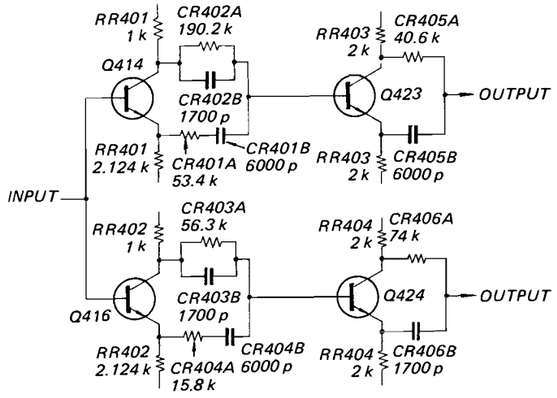


Fig. 3. Circuit diagram of PSN

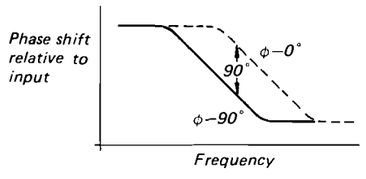


Fig. 4. Characteristic of phase shifter

A resistor R is added at the collector as shown in Fig. 5 in addition to RR (Pair Parts). This resistor compensates for the offset which appears on a internal resistance re between base and emitter.

$$R = re\ [\frac{26}{Ie}]\ \Omega$$

Transistors Q433 and 434 are used to switch between the LSB (Lower Side-Band) and USB (Upper Side-Band) which are obtained by inverting one of the phases of the modulation input in phasing type SSB.

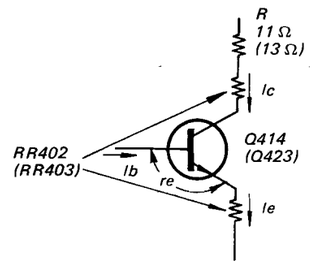


Fig. 5.

(2) Balanced Modulator (MOD)

The two 0° and –90° signals passed through the PSN are input to the balanced modulator consisting of IC401 and 402 through Q435 and 437. The carrier is 455 kHz and input signals are modulated to two DSB which have 90° phase difference, at both MOD. The DC gains of both ICs are determined by R485 and 486, and the AC gains are determined by R479 and 480, and the signal input sections are DC balanced by VR405 and 406. The balanced modulator outputs are DSB, but become SSB by combining these outputs at R572 and 573.

Note: VR405 and 406 are for SSB carrier suppression adjustment.

The SSB output (LSB or USB) is passed through Q439 and IFT401 and sent to the frequency converter of transmitter with 455 kHz as the reference frequency.

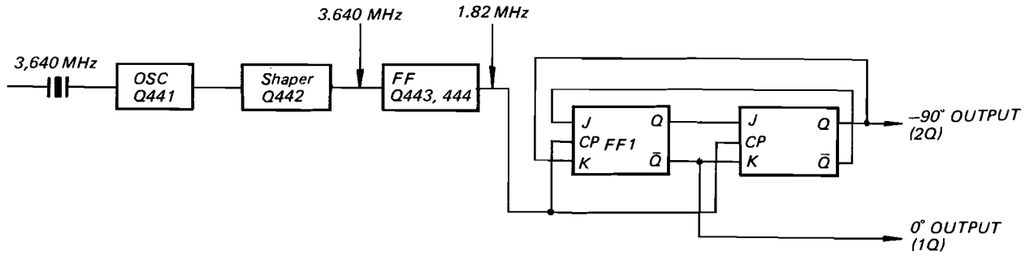
(3) 455 kHz Carrier Generator

Two 455 kHz signals are produced by Q441 – 446 and IC403. For transmitting, these two signals are given a phase difference of 90°. The carrier source of this generator is the 3.640 MHz signal produced by a crystal oscillator.

This frequency is divided to ½ by the FF (Flip-Flop) consisting of Q443 and 444 to produce 1.820 MHz. This FF is not used to merely divide frequency, but also serves to shape the pulses from the wave shaper Q442 to a square wave and the FF operates as the interface to adjust to the input level of IC403.

IC403 (C MOS) contains two sets of master-slave JK FF and the inputs of FF1 are connected alternately by the outputs of the next stage (FF2). When both J and K are "1", this type of FF divides the CP input by ½ at each clock (CP) input pulse. However, J or K becomes "0" with the connection shown in Fig. 6. If we assume that Q is "0" and $\bar{Q}$ is "1" in FF2 and a 1.82 MHz pulse is applied to CP, as illustrated in Fig. 7, the 1.82 MHz pulse in divided to ¼, and at the same time the divided 455 kHz signals are shifted by the period of CP (clock time). The two 455 kHz signals of FF1 and FF2 outputs have 90° phase difference.

Since CP inputs operate by the positive-going edge of the Q444's output pulse, the output waveform of FF produced by Q444 need not be exactly symmetrical (duty may not be 50 %).



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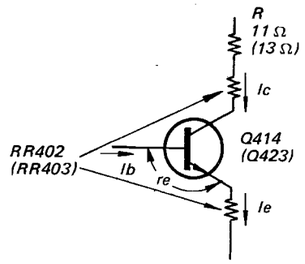

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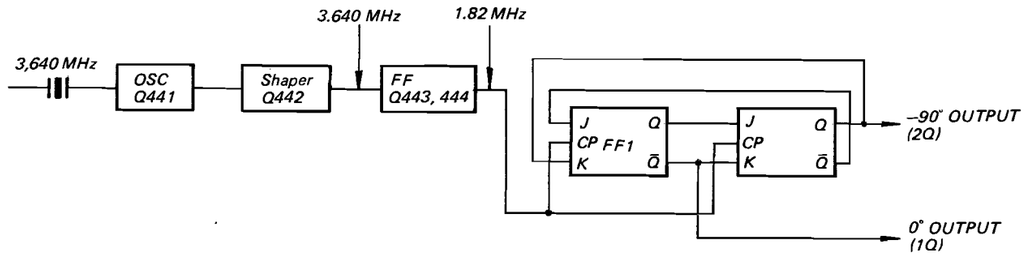


Fig. 6.

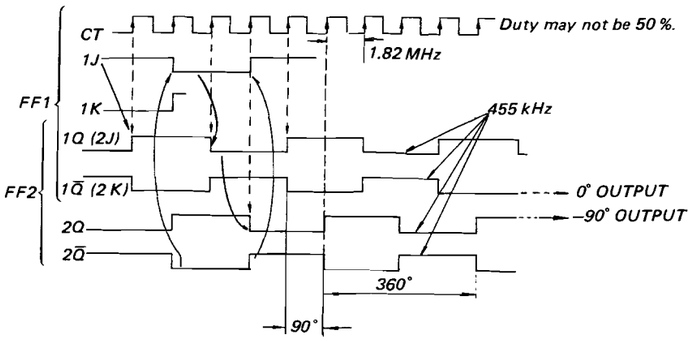


Fig. 7. Time chart of FF1 and FF2

(4) Unnecessary Sideband

When SSB is produced, it has an unnecessary sideband remaining. This is illustrated in Fig. 8.

This unnecessary sideband is related with accuracy of RF and AF phase shift and accuracy of AF signal level as shown in Fig. 9.

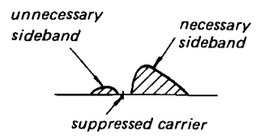


Fig. 8. SSB signal

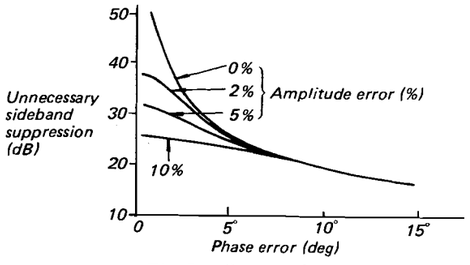


Fig. 9. Suppression ratio

(5) IC403 MSM4027

The connections are shown in Fig. 10.
R is the reset input. When R is assumed to be "1" and the set input (S) is "0", output Q becomes "0" without regard to the clock. When R is not used, R is made "0". When the set input (S) is "1" and the reset input (R) is "0", output Q becomes "1" without regard to the clock. When S is not used, S is made "0".

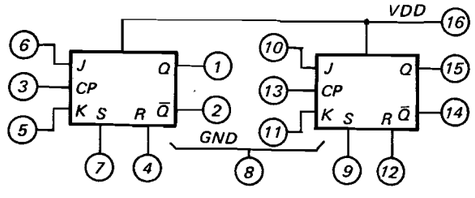


Fig. 10. MSM4027

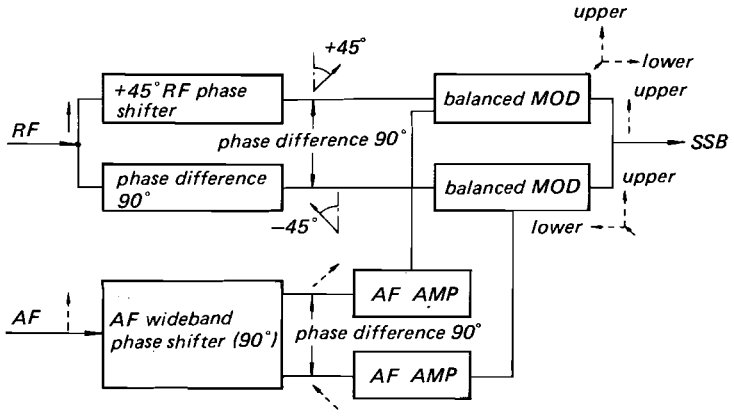


Fig. 11. Reference circuit of SSB generator

(6) Encapsulated and Special Components

a) Special components (Fig. 12)

This set uses a total of twelve special components in the PSN circuit of the SSB generator section. If even one of these components is defective, all twelve components must be replaced. When replacing these components, confirm that the colored dot at the top of the components is the same color (matched pair classification). Individual data are shown in the below table. The pair color coding is described here.

Table 1. Special components

Center of allowable	Numbers of dots	Color of dots	Part No. of 12-piece kit
-2.75%	1	brown	9-831-024-11
-2.25%	1	red	
-1.75%	1	orange	
-1.25%	1	yellow	
-0.75%	1	green	
-0.25%	1	blue	
+0.25%	1	violet	
+0.75%	1	gray	
+1.25%	1	white	
+1.75%	2	brown and white	
+2.25%	2	brown and brown	
+2.75%	2	brown and red	

After the 12-piece kit has been received, confirm that the dots of the twelve components are the same color. Next, check the part number printed on the face of each of the twelve components against the table on page 2.

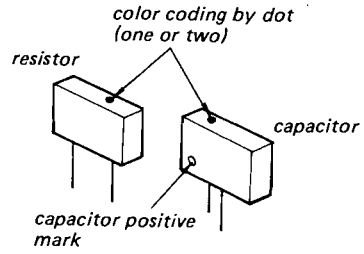


Fig. 12. Special component

b) RR Encapsulated Components

Moreover, four RR encapsulated components are also used in the SSB generator. The shape, interior and part number are shown below. Only one of these may be replaced when faulty.

When using these components, RR401 and 402 must be used with the 1 kΩ (R1) at the collector so that the resistance value given in the circuit diagram is obtained.

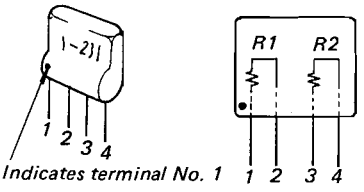


Fig. 13. RR encapsulated component

Table 2. RR encapsulated components

Part No.	R1	R2	Use
1-231-324-11	1000 Ω	2124 Ω	RR401
1-231-324-11	1000 Ω	2124 Ω	RR402
1-231-317-11	2000 Ω	2000 Ω	RR403
1-231-317-11	2000 Ω	2000 Ω	RR404

c) LPF401

LPF401 may be used in either direction (IN/OUT reverse).

3. VXO (Variable X'tal Oscillator)

The 10.24 MHz carrier is produced by a crystal oscillator. The output of this oscillator is used as follows:

local oscillator output for 1st mixer in TX mode
local oscillator output for 2nd mixer in RX mode
PLL reference frequency output

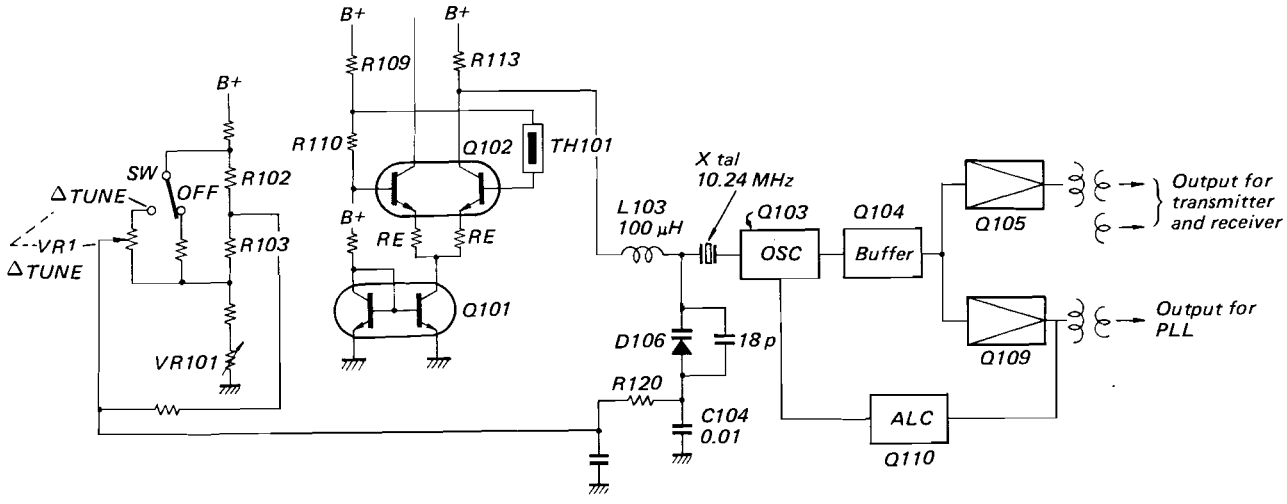


Fig. 14. Block diagram

The crystal resonant curve is shown below.

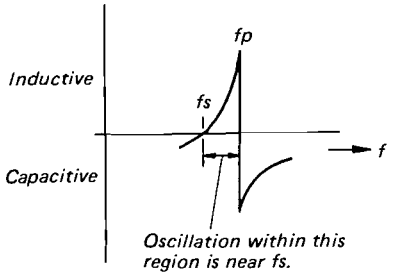


Fig. 15. Crystal resonant curve

Crystal oscillates between fs (series resonant point) and fp (parallel resonant point) and this resonant curve signifies that the frequency is variable within this region.

(1) Oscillation

Oscillation is performed with an 18 pF capacitor and the internal capacitance of D106 added to the crystal by a circuit equivalent to Clapp oscillator.

A 10.240 MHz crystal is used, but it resonates at 10.240 MHz when an additional 24.5 pF capacitor is added.

The crystal is a soldering type equivalent to the HC18/U. In order to oscillate 10.240 MHz, a part of the added capacitor is replaced by variable-capacitance diode D106 and the control voltage to this diode is adjusted to set the frequency. VR101 is for the frequency setting.

These are three oscillation outputs. Of these, the PLL amplifier output is used to apply ALC (Automatic Level Control) to the oscillator and it maintains the oscillation output constant at all times.

(2) Power Supply Regulation

The stability of this circuit is governed by the power supply voltage. Therefore, a exclusive circuit which stabilizes the voltage by clamping the base voltage of the darlington DC amplifier Q106 – 108 with a zener diode is provided.

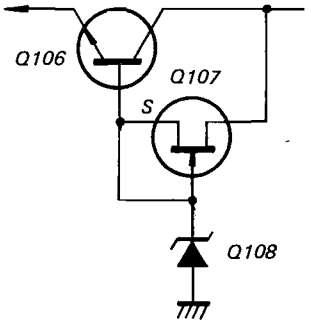


Fig. 16.

(3) Temperature Compensation (Fig. 14)

Since surrounding temperature changes cause the frequency to change, its compensation is vital. This is especially severe in mobile use. Consequently, the circuit using Q101, 102 and Th101, which supplies the bias to + side of D106, is provided. Q102 is a dual-transistor which is mounted on the one pellet in a single package in order to get the same ambient conditions.

The dual-transistor forms a differential amplifier with the return of each R_E floated at DC supply Q101 (right side).

The two transistors are controlled by themselves through their emitters. A reference voltage and a DC voltage corresponding to the temperature change are applied to the each base, so a compensation use variable voltage is extracted.

(4) Th101 Position

Th101 is used to transfer the temperature changes to the right side of Q102. This element is attached to the case of the crystal with thermal compound and the temperature of the crystal is faithfully fed back at all times.

(5) Q101's base source

The Q101's base voltage is obtained by connecting the other transistor as a diode. The left and right pellets of Q101 are in the same package and its characteristics may be considered to be the same since those use the adjacent pellets which cut out from the same wafer. External temperature changes also occur simultaneously inside Q101, so the thermal changes between both pellets can be neglected.

(6) ΔTUNE

In SSB, even slight deviation of the frequency (carrier) makes demodulation impossible, but Δ TUNE (delta tune) (VR1) is provided to correct this. The frequency relationship when transmitting +260 Hz SSB or receiving +260 Hz SSB is shown in Fig. 17.

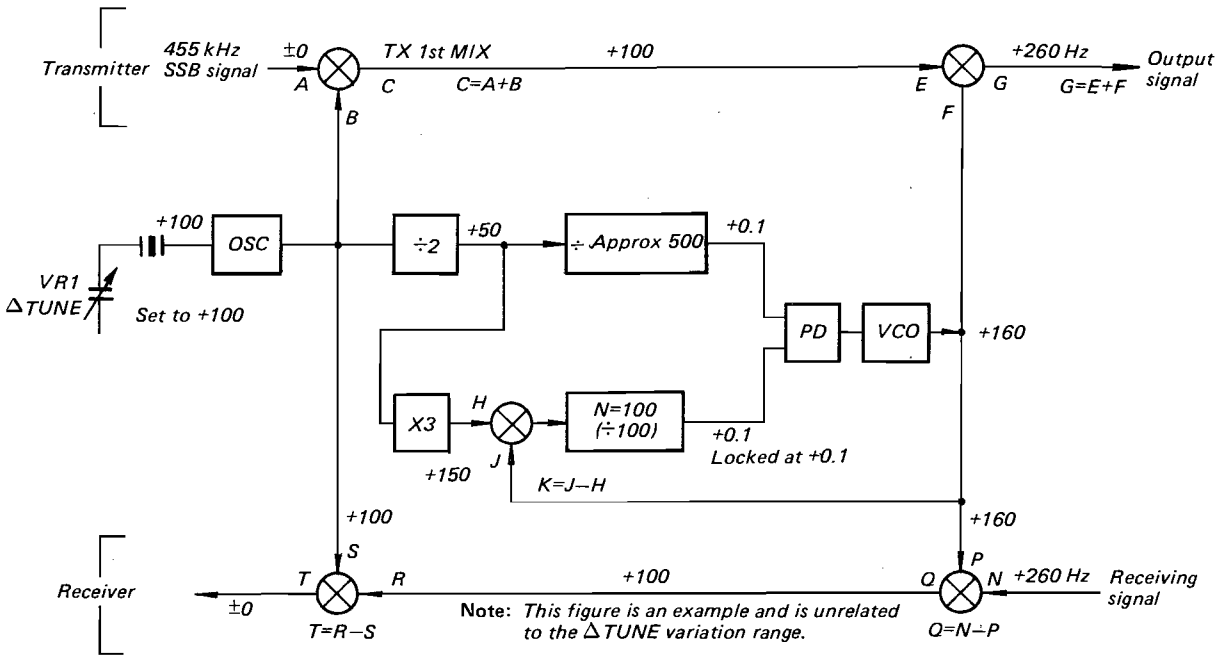


Fig. 17. Frequency relationship

If the other station can transmits and receives on the same frequency, the transmitting frequency is the frequency which should be received and is as shown in Fig. 17. Consequently, when the other station had a frequency offset only for receiving, perform the procedure described below.

1. Receive the station's signal and set the ΔTUNE to the point at which demodulation is optimum.
2. Transmit to the station without any frequency alteration and request the station to eliminate his receiving frequency offset.

Communication becomes possible with this method. When the other station's signal has offset at transmitting and receiving, for example, ± 0 is transmitted and +260 is received, communications cannot be established if it is considered as severe as shown below.

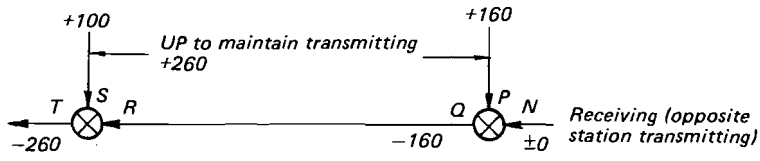


Fig. 18. Frequency offsetting

4. PLL Synthesizer Circuit Operation

The block diagram of this circuit is shown below.

As shown in Fig. 19, the frequency of each point is distributed and the VCO (Voltage Controlled Oscillator) is oscillated between 16.27 – 16.71 MHz in 10 kHz steps according to the position of the CH1 – 40 selector. The VCO output is compared with the 10 kHz reference signal obtained by dividing the 10.24 MHz of the X'tal at the PD (Phase Detector) and this system is controlled so that the PD input is maintained at 10 kHz by the PD output.

Since this PD controls the system to detect the phase difference, this system is called the PLL (Phase Locked Loop) type, and is a kind of frequency synthesizer.

(1) Reference Frequency

The 10 kHz extracted from the DO (Divider Output) is the reference signal. In the case of the simple system, this signal is closely related to the output-frequency steps, therefore the use of 10 kHz for 10 kHz steps of the output is considered suitable. The 10.24 MHz from the X'tal oscillator is supplied to the divider to convert it to 10 kHz. The divider (fixed) consists of ½ and $1/512$ divider to divide the 10.24 MHz signal into $1/1024$.

(2) 2nd Local Oscillator

When 455 kHz is used as the 2nd IF and the image ratio is considered, the 1st IF should not be lower than the INPUT frequency. This set uses double superheterodyne with the 1st IF of about 10 MHz.

If the 1st IF is about 10 MHz, the 2nd local oscillator's frequency can be 10.24 MHz of the reference, and a 1st IF should be 10.695 MHz which is made from 455 kHz + 10.24 MHz.

(3) 1st Local Oscillator

If the 2nd local oscillator signal is fixed in frequency, the 1st local oscillator should determine the receiving frequency in 10 kHz steps. The local oscillator signal from the VCO is controlled and supplied by the PLL frequency synthesizer. The frequency is 16.27 – 16.71 MHz which is lower than the input signal frequency by 1st IF.

(4) VCO Scaling

Because about 1 MHz is the most suitable input frequency at the programmable divider, the frequency of the VCO is lowered by heterodyne converter Q206. Here, the input is the 16 MHz band, and therefore, the local oscillator must be the 15 MHz band.

This is attained by 10.24 x 1.5. 10.24 MHz is divided by 2 to produce 5.12 MHz and 15.36 MHz is produced by taking the 3rd harmonic of this 5.12 MHz signal by means of a tripler transformer T204. For example, when the VCO oscillates at 16.27 MHz, the 16.27 MHz signal is mixed with this 15.36 MHz and the resultant 910 kHz reaches to the divider input.

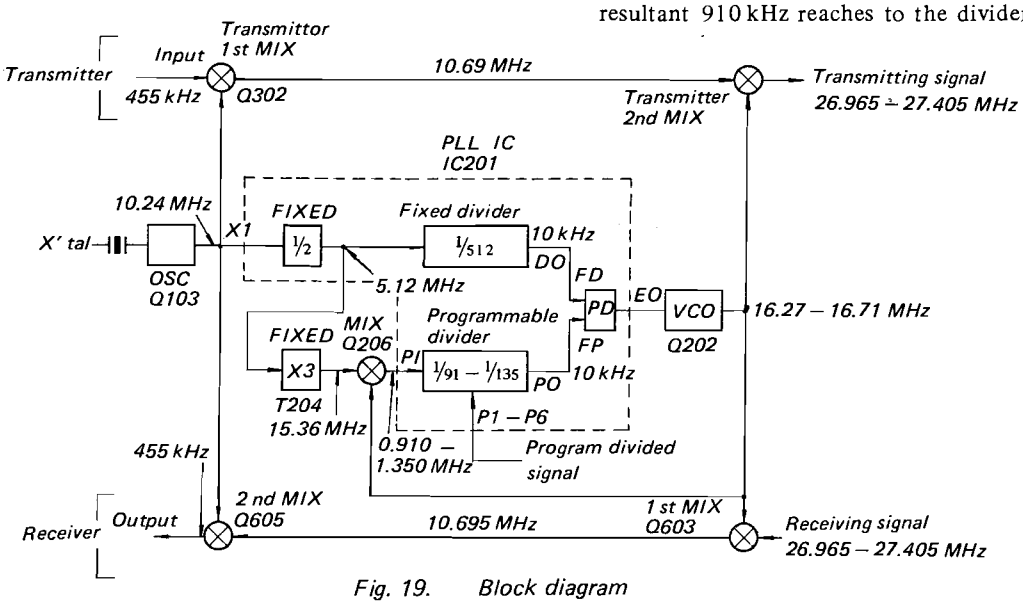


Fig. 19. Block diagram

5. Programmable Divider

The input from the VCO is converted to 10 kHz by this divider and the phase is compared at PD. Here, the desired lowest frequency at which the VCO oscillates is 16.27 MHz. Consequently, the 15.36 MHz mixed at Q206 is subtracted from 16.27 MHz to obtain 0.91 MHz.

16.27 MHz – 15.36 MHz = 0.91 MHz

Since the division ratio (N) to obtain 10 kHz is 1 : 91, if the 0.91 MHz signal is divided by 91, 10 kHz is obtained at the output. Moreover, since the maximum frequency at which the VCO oscillates is 16.71 MHz.

16.71 MHz – 15.36 MHz = 1.35 MHz

N = 1.35 MHz : 10 kHz = 135

Therefore, when the VCO oscillates at 16.27 – 16.71 MHz, N of the divider must be set to 91 – 135.

(1) Step of N

This section is explained about numbers of the divider input N. Since the oscillation frequency of each channel of the VCO is set in 10 kHz steps, to find the division ratio of CH2, the oscillation frequency of the VCO is increased 10 kHz from CH1 to 16.28 MHz

16.28 MHz – 15.36 MHz = 920 kHz

Thus, N = 920/10 = 92.

If varied in steps of N, the VCO frequency is varied in 10 kHz steps. That is, the 90 offset number at the citizen's band channel is N. However, the frequency is not changed in 10 kHz steps between any adjacent channels.

(2) Instruction of N

91 – 135 should be input to designate N at the programmable divider. However, instruction from the outside may use other numbers if there is a program converter in the IC. The IC contains the code converter which automatically selects N by inputting the most appropriate number, that is, CH number. In this way, the CH number is input by *BCD code, and this code depends on the LOW or HIGH DC level applied to terminals P1 – P6 of IC201.

Note: PROGRAM INPUT is logic . . . That is,
1 = HIGH level
0 = LOW level (GND)
*BCD : Binary-Coded Decimal

Table 3. Value of N (input/output frequency ratio of the divider) versus channel No.

CH No.	Transmitting receiving frequency (MHz)	VCO frequency 10.695 MHz lowered (MHz)	Divider input frequency lowered by heterodyne (kHz)	N of programmable divider	CH No.	Transmitting receiving frequency (MHz)	VCO frequency 10.695 MHz lowered (MHz)	Divider input frequency lowered by heterodyne (kHz)	N of programmable divider
1	26.965	16.270	910	91	21	27.215	16.520	1,160	116
2	26.975	16.280	920	92	22	27.225	16.530	1,170	117
3	26.985	16.290	930	93	23	27.255	16.560	1,200	120
4	27.005	16.310	950	95	24	27.235	16.540	1,180	118
5	27.015	16.320	960	96	25	27.245	16.550	1,190	119
6	27.025	16.330	970	97	26	27.265	16.570	1,210	121
7	27.035	16.340	980	98	27	27.275	16.580	1,220	122
8	27.055	16.360	1,000	100	28	27.285	16.590	1,230	123
9	27.065	16.370	1,010	101	29	27.295	16.600	1,240	124
10	27.075	16.380	1,020	102	30	27.305	16.610	1,250	125
11	27.085	16.390	1,030	103	31	27.315	16.620	1,260	126
12	27.105	16.410	1,050	105	32	27.325	16.630	1,270	127
13	27.115	16.420	1,060	106	33	27.335	16.640	1,280	128
14	27.125	16.430	1,070	107	34	27.345	16.650	1,290	129
15	27.135	16.440	1,080	108	35	27.355	16.660	1,300	130
16	27.155	16.460	1,100	110	36	27.365	16.670	1,310	131
17	27.165	16.470	1,110	111	37	27.375	16.680	1,320	132
18	27.175	16.480	1,120	112	38	27.385	16.690	1,330	133
19	27.185	16.490	1,130	113	39	27.395	16.700	1,340	134
20	27.205	16.510	1,150	115	40	27.405	16.710	1,350	135

Note: ○ f_{IF} = 10.695 MHz
○ Freq. for heterodyne: 15.36 MHz (beat down)

○ Note that all channels are not N offset by only 90 at the CH No. This is because there are blanks and frequencies having a special arrangement at the citizen band channels.

(3) Channel Display and Program Code Table

The program input of the μPD861C used is the CH No. input at terminals P1 – P8 in BCD code. Furthermore, the terminal M is maintained at a HIGH level at this time, and the operation is as shown below,

1. INPUT is received in BCD code.
2. Offset 90 is performed.

Note: BCD : Binary-Coded Decimal

Table 4. Channel display and program cord

CH No.	(Pin 1) P1	(Pin 2) P2	(Pin 3) P3	(Pin 4) P4	(Pin 5) P5	(Pin 6) P6	CH No.	(Pin 1) P1	(Pin 2) P2	(Pin 3) P3	(Pin 4) P4	(Pin 5) P5	(Pin 6) P6
1	1	0	0	0	0	0	21	1	0	0	0	0	1
2	0	1	0	0	0	0	22	0	1	0	0	0	1
3	1	1	0	0	0	0	23	1	1	0	0	0	1
4	0	0	1	0	0	0	24	0	0	1	0	0	1
5	1	0	1	0	0	0	25	1	0	1	0	0	1
6	0	1	1	0	0	0	26	0	1	1	0	0	1
7	1	1	1	0	0	0	27	1	1	1	0	0	1
8	0	0	0	1	0	0	28	0	0	0	1	0	1
9	1	0	0	1	0	0	29	1	0	0	1	0	1
10	0	0	0	0	1	0	30	0	0	0	0	1	1
11	1	0	0	0	1	0	31	1	0	0	0	1	1
12	0	1	0	0	1	0	32	0	1	0	0	1	1
13	1	1	0	0	1	0	33	1	1	0	0	1	1
14	0	0	1	0	1	0	34	0	0	1	0	1	1
15	1	0	1	0	1	0	35	1	0	1	0	1	1
16	0	1	1	0	1	0	36	0	1	1	0	1	1
17	1	1	1	0	1	0	37	1	1	1	0	1	1
18	0	0	0	1	1	0	38	0	0	0	1	1	1
19	1	0	0	1	1	0	39	1	0	0	1	1	1
20	0	0	0	0	0	1	40	0	0	0	0	0	0

Note:
- All zero is programmed in only at CH40.
- 0 ≒ GND level (LOW).
- 1 = + level (HIGH).
- P7 and P8 are used to hold at 0 and therefore not indicated.

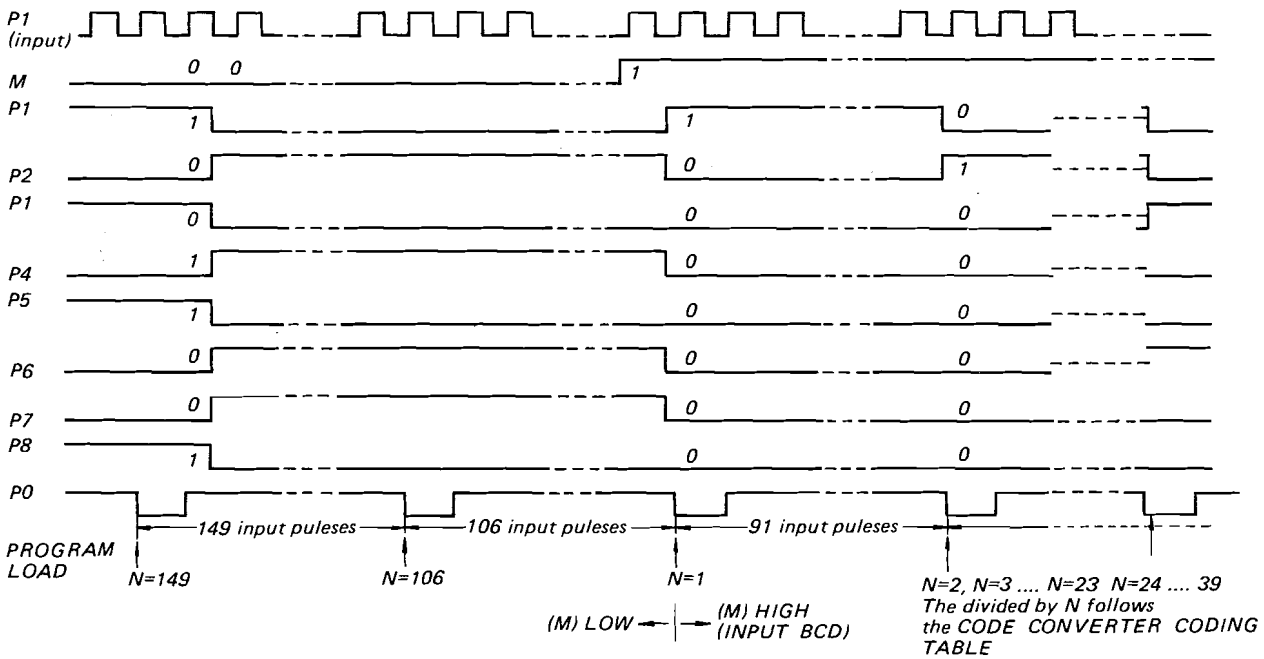


Fig. 20. Timing diagram of the programmable divider section

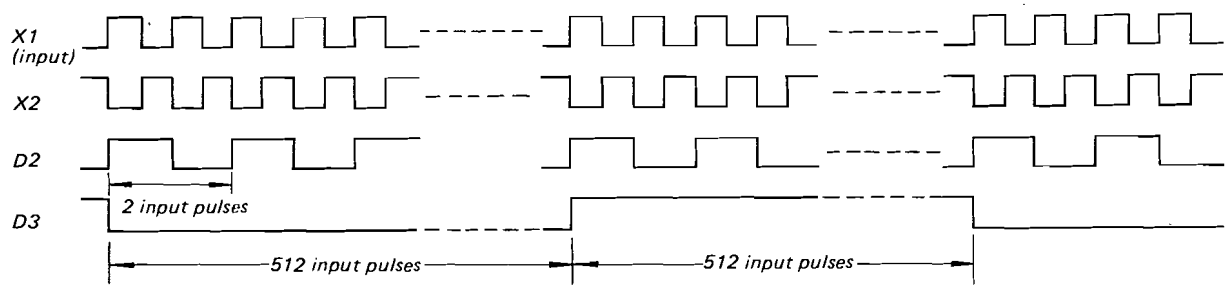


Fig. 21. Timing diagram of the divider section

6. Phase Detector

The block diagram of the phase detector is shown below.

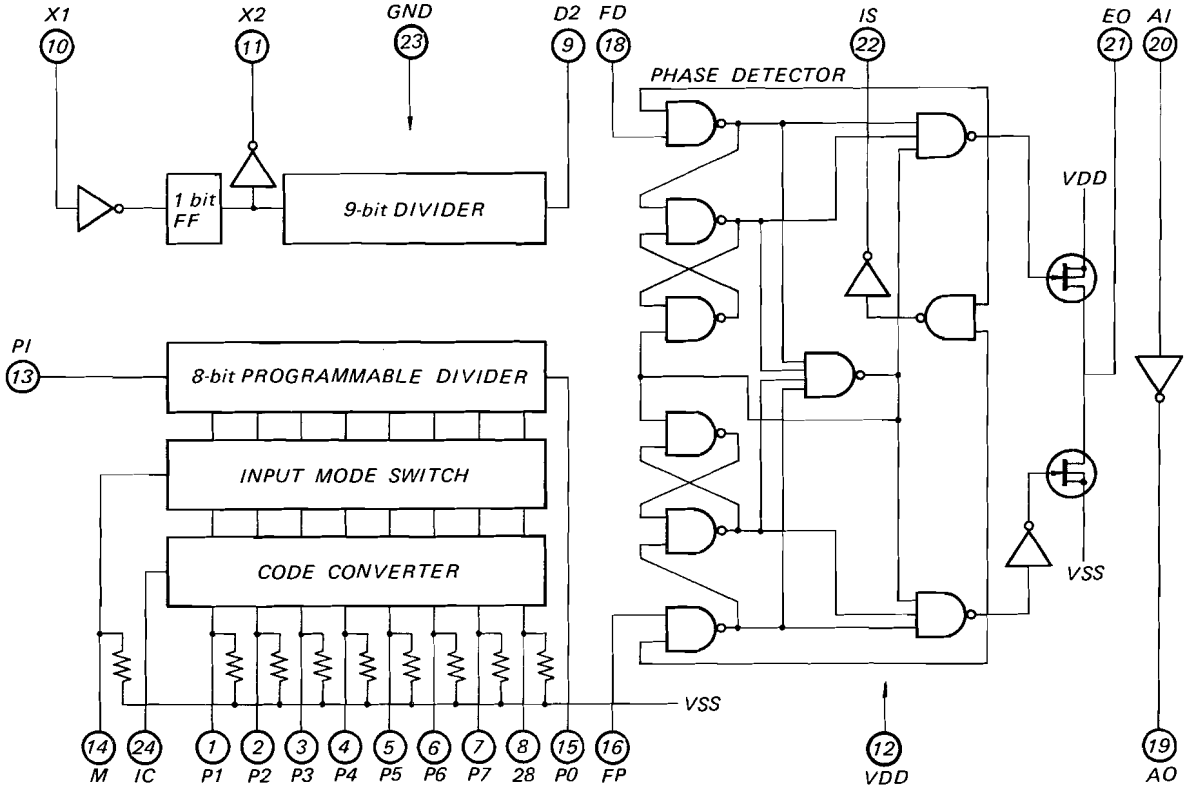


Fig. 22. Block diagram

As shown in the above figure, the phase detector is a digital detector consisting of a combination of gates. This circuit consists of a block which compares the phases of inputs FD and FP and a charge pump which outputs the result of this comparison. Phase comparison is performed at the rising edge of the input pulse.

As illustrated in Fig. 23, if the phase of FP leads the phase of FD, the output becomes HIGH (1) level. If the phase of FP lags the phase of FD, the output becomes LOW (0) level. If the two inputs are the same phase, the charge pump output becomes high impedance. As a result, a phase difference of up to ± 360° between the two inputs is detected.

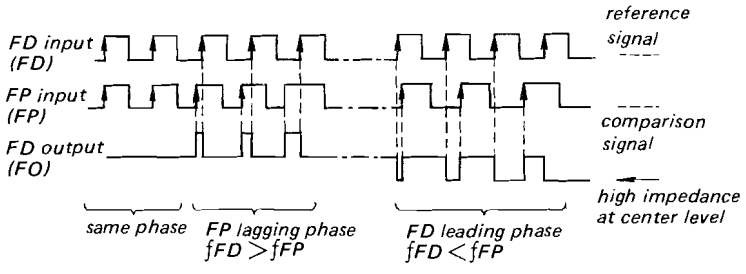


Fig. 23. FD output

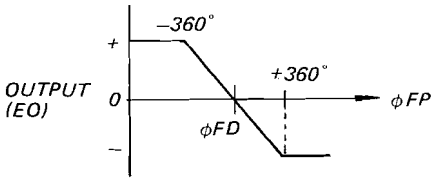


Fig. 24. Charge pump output

(1) Charge Pump

A CMOS IC is used in the charge pump. As shown in Fig. 25, this circuit is a push-pull circuit with an inverter to convert the input polarity connected to one of the gates.

When D is 1 and P is 0, a positive voltage is applied to Q2 (N channel) by the inverter, Q2 is turned ON and C is discharged. When P is 1 and D is 0, Q1 (P channel) gate is turned ON and C is charged.

When both D and P are 1, both Q1 and Q2 are turned OFF, Eo is floating and the charging voltage of C is held at the previous value of which Q1 and Q2 were turned OFF.

This hold time is inversely proportional to the gate leakage current of Q1 and Q2. However, when the hold time becomes longer, Eo is maintained at a fixed value and the VCO controlled by Eo can continue oscillating at a fixed frequency for an extended period of time.

(2) IS (Unlock stop)

The inputs from D and P of the charge pump are output as IS through an AND circuit. If this logic AND is considered to be two diodes as illustrated in Fig. 26, its operation is as shown below.

That is, the output is "1" only when both D and P are "1". Since D and P become "1" when the PLL is locked, that is, when the frequency is stable, a transmittable and receivable signal is output at this time. Specific connections are shown below.

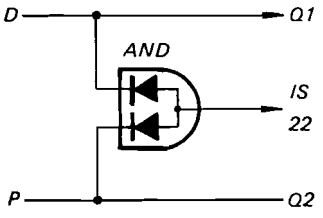


Fig. 26. AND circuit

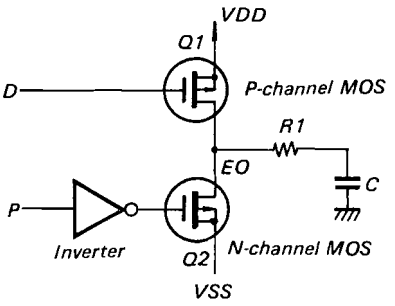


Fig. 25. Charge pump

As shown in Fig. 27, since the PLL oscillator output is passed through Q204 for both receiving and transmitting, if operation of Q204 is halted, transmitting and receiving are also stopped.

Normally, Q204 is operated by bias V_B (F) through R228. On the other hand, a V_B (R) close to B+ is supplied to the base of Q209 (PNP transistor) through R225 and Q209 is cut off. Since the IS terminal is also "1", D202 is cut off.

When the unlock STOP signal "0" appears at IS terminal 22, Q209's base current flows through D202, Q209 is turned ON and the emitter of Q204 and B+ are connected. This cuts off Q204.

This is extremely important in that it prevents scanning during transmission in the CB band.

Table 5. IS output

Input (D)	Input (P)	Output (IS)
0	0	0
0	1	0
1	0	0
1	1	1

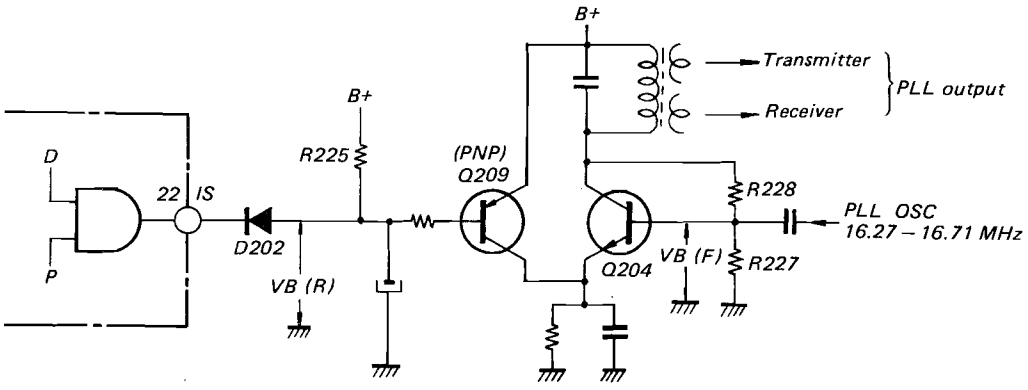


Fig. 27. Operation of IS signal

(3) Active Filter and VCO Connection

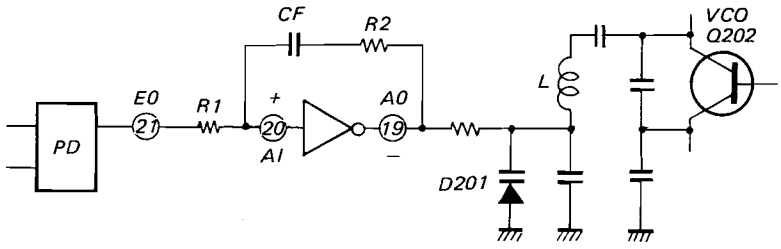


Fig. 28. Active filter and VCO connection

The active filter (L.P.F.) basically consists of R1 and CF to made 6 dB/oct curve, and the negative feed-back from CF extends the linear range of this filter. When R2 is not provided, this LPF is not operated at high pitch input variations. Therefore, R2 is added to prevent this occurs. The frequency response of the LPF is shown in Fig. 29.

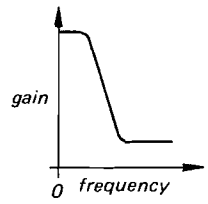


Fig. 29. Frequency response of LPF

(4) Phase Detector Overall Operation

Considering overall operation, if the frequency of the VCO is assumed to be higher than desired,

- The PD output (Eo) sends out positive-going pulse close to VDD.
- This pulse is filtered by the active filter, and since the filter amp inverts the polarity, the filter output is DC approaching ground level.
- The reverse bias applied to the diode D201 decreases and its equivalent capacitance increases.
- Since D201 is connected as part of C of the VCO oscillation-use LC, the oscillation frequency decreases and is locked at the objective frequency.

(5) μPD861C

Since the internal operation has already been described in the PLL section, other operations are described here.

V_{CC} is 5 V.
The divided range of the programmable divider is 3 – 255. Moreover, the maximum frequency input of this divider is approximately 2 MHz.

N for 26.955 MHz, 27.045 MHz and some channels in the CB band is not incorporated in this PCC IC. The maximum frequency of the divider between X1 and X2 is 11 MHz. LOW (0) and HIGH (1) for all the signal inputs and outputs indicate:

0 . . . . . 1 V or less
1 . . . . . 4 V or greater

To give commands to the divider in BCD code, the terminal M is HIGH level to get 90° offsetting. When this terminal M is held LOW, the divider is not performed at 90° offsetting and is divided by the specified number of the BCD cord.

N of 0 – 2 must not be programmed when direct division is performed.

7. Channel Selector Switch and Channel Display

The channel selector switch consists of the following three switches:

S3 EMERGENCY
S4 PRESELECT CHANNEL
S2 CHANNEL

The priority order of these switches is S3, S4, and S2. S3 has the highest priority.
These switches and the channel display circuit and the circuitry up to the divide command signal to the PLL IC are illustrated below.

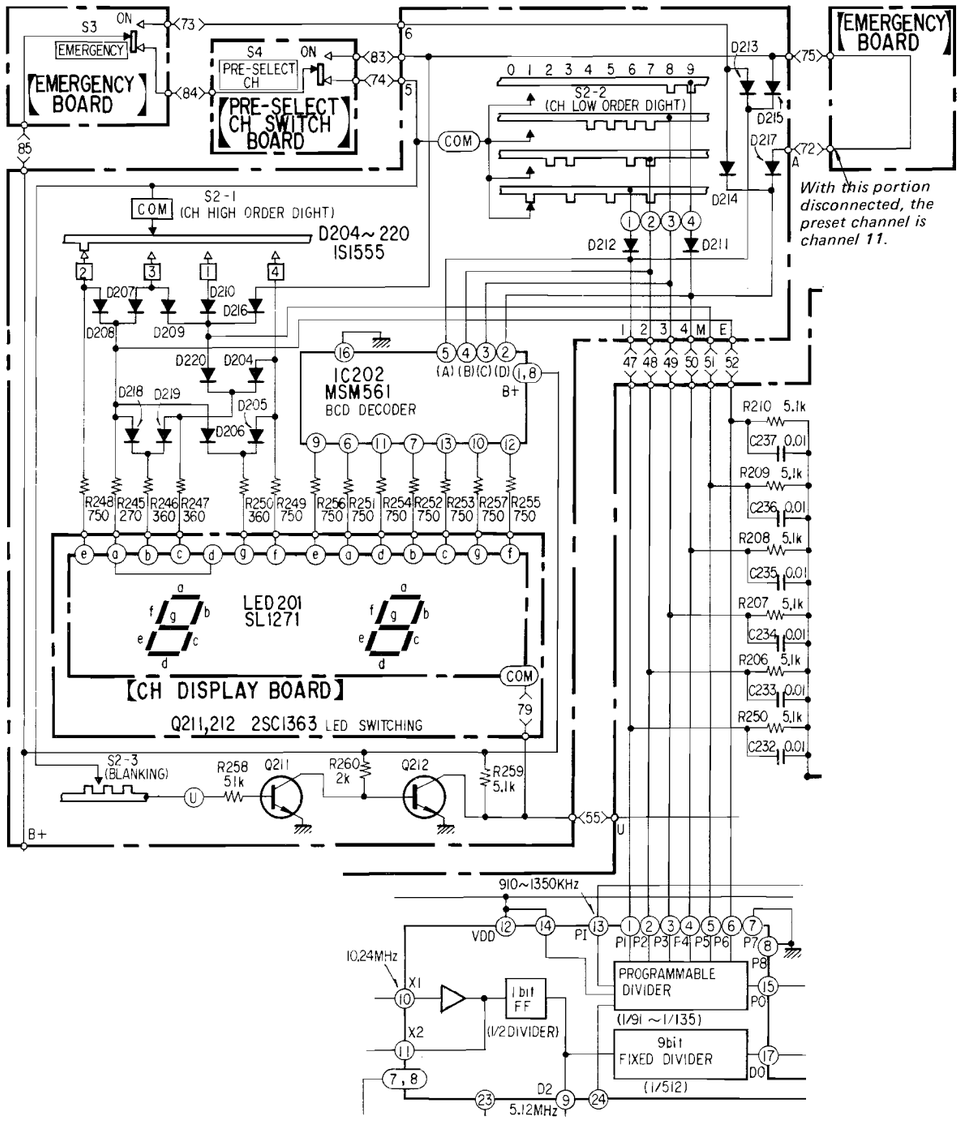


Fig. 30. Channel display circuit

(1) Overall Standpoint

Channel display is performed by 2-digit LED display indicating channels 1–40. The upper digit is blanked for channels 1–9. The upper digit is driven by a diode matrix and the lower digit is driven by the BCD code switch output through 7-segment code converter IC202.

When either the EMERGENCY or PRESELECT CH switch is set to ON, the frequency is fixed on the predetermined EMERGENCY or PRE-SELECT CH and the display is also switched to that channel no matter what channel the CHANNEL switch is set to.

(2) Operation of The Three Contacts of S2

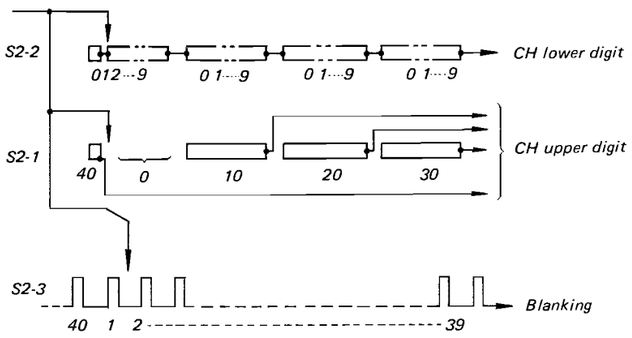


Fig. 31. CHANNEL switch

As shown in Fig. 31, S2-3 is ON while the channels are being switched. S2-1 is blanked at channels 1–9 and ON at channels 10–19, 20–29, 30–39 and 40 and their respective channel-use outputs are output.

S2-2 sends the respective BCD cord signal of channels 0–9 four times when the channel is changed between 1–40.

Switching from another channel to channel 8 is described here. During switching S2-3 is turned ON, Q210 is turned ON, Q211 is turned OFF, the common terminal (COM) of LED is opened and the LED displayed is extinguished. Since S2-1 is stopped at "0", current doesn't flow in the upper digit of the LED and nothing is displayed. Moreover, since there is no PLL IC in the upper digit use program voltage (P5, P6 use) from the upper digit diode matrix, the BCD cord of the upper digit becomes "00".

S2-2 is advanced to 8, only the topmost slider of the four sliders is ON, the other sliders are OFF and "1000" is extracted in BCD code. This output "1000" is sent to P4–P1. When the switch is set to CH8, "001000" is input in BCD code at P6–P1 of the PLL IC.

The lower digit "1000" is input at the IC202's 7-segment code converter, current flows in all the LED electrodes (a–g) corresponding to the display from the interior and 8 is displayed at the lower digit of the LED.

When the EMERGENCY switch (S3) is set to ON with the CHANNEL switch set to 8, B+ of the PRESELECT CH (S4) and CHANNEL (S2) switches is turned OFF. "1" is input directly to P4 and P1, the input of P4–P1 becomes "1001", that is 9 and CH9 is selected and 9 is also displayed.

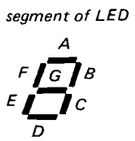
When the PRESELECT CH (S4) is set to ON with S3 turned OFF, since S4 takes precedence of S2, "1001" is input at IC202 for the lower digit and "1" is input at the b and c terminals of the upper digit. Consequently, channel 19 is selected and "19" is displayed.

(3) IC202 MSM561

The outputs for the LED segments change relative to BCD input as shown in the below table:

Table 6. LED drive code table

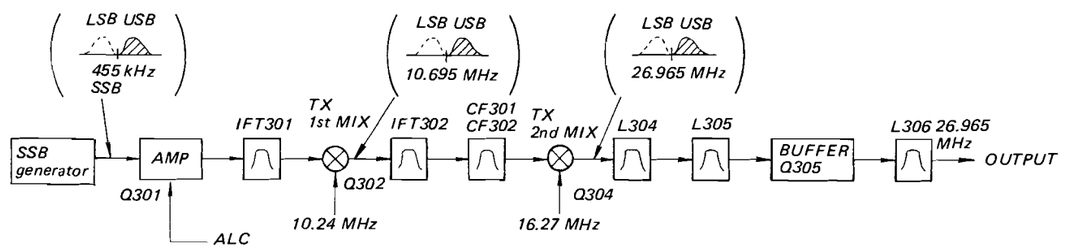
INPUT				Number displayed	OUTPUT						
D (P1)	C (P3)	B (P4)	A (P5)		A (P6)	B (P7)	C (P11)	D (P13)	E (P9)	F (P12)	G (P10)
0	0	0	1	1	0	1	1	0	0	0	0
0	0	1	0	2	1	1	0	1	1	0	1
0	0	1	1	3	1	1	1	1	0	0	1
0	1	0	0	4	0	1	1	0	0	1	1
0	1	0	1	5	1	0	1	1	0	1	1
0	1	1	0	6	1	0	1	1	1	1	1
0	1	1	1	7	1	1	1	0	0	1	0
1	0	0	0	8	1	1	1	1	1	1	1
1	0	0	1	9	1	1	1	1	0	1	1
0	0	0	0	0	1	1	1	1	1	1	0



8. TX (transmitter) Frequency Converter

The SSB wave produced at 455 kHz ± 1.5 kHz by the SSB generator is sent to the TX frequency converter. This converter consists of Q301 to Q305.

Taking CH1 as an example, the signal frequency is converted twice to 26.965 MHz as illustrated in Fig. 32.



Q304 is a balanced-type mixer.

Fig. 32. Block diagram of transmitting CH1

(1) Sideband Inversion

Since the output of the frequency converter is the sum of the input both times, the sidebands are not inverted between the two conversions. . (Heterodyning of sum)

455 kHz + 10.24 MHz = 10.695 MHz

10.695 MHz + 16.27 MHz = 26.965 MHz

Input signal | Local oscillator signal | Output signal

Consequently, if the 455 kHz SSB of the converter input is the USB, the 26.965 MHz output signal is also the USB signal.

(2) Rejection of Undesired Sideband After Conversion

There is a total of four signals, two frequency outputs (sum and difference of inputs) and inputs at the output after the 1st mixer as shown in Fig. 33.

Since 10.695 MHz is output here, 3-stage bandpass filters of IFT302, CF301 and 302 are added to remove the strong 10.24 MHz carrier and 9.785 MHz image SSB.

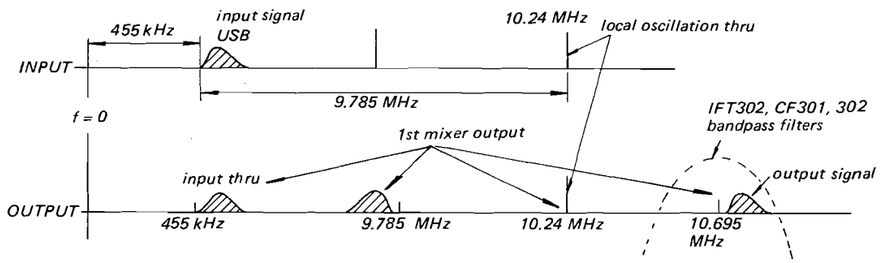


Fig. 33. 1st mixer output signals

The following frequencies are output after the 2nd mixer.

However, the 2nd mixer local oscillation varies about 400 kHz and the output signal varies between 26.965 MHz and 27.405 MHz, so the bandpass filter is required to expand the frequency range as shown in Fig. 34.

If the 2nd mixer output signal has mixing leakages, the leakages will be amplified by the power amplifier and be emitted from the antenna. So a balanced type mixer is used at the 2nd mixer of this transceiver to prevent the output of leakages.

(4) ALC (Automatic Level Control)

ALC is performed by detecting the final output level, converting it to a DC voltage and applying this DC voltage to gate 2 of the first stage Q301 of this mixer. ALC is described in detail in the TX output section on page

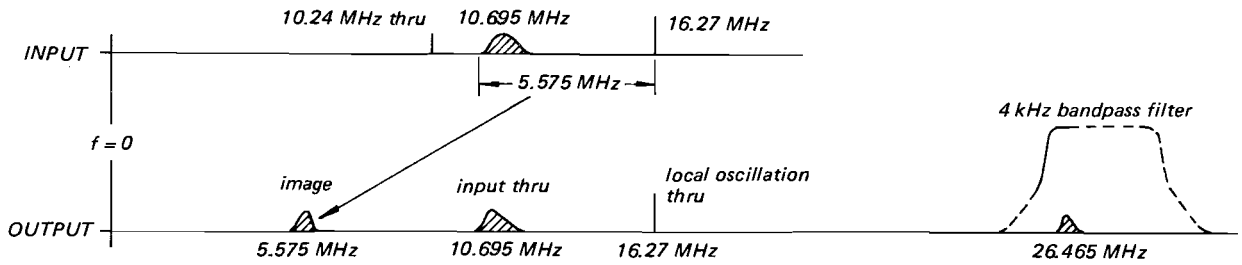


Fig. 34. 2nd mixer output signals

(3) Balanced Mixer

This circuit is a push-pull circuit using a pair of FET and the input signal is applied to the sources of both FET with the same phase so that high-level signal of local oscillation adjacent to the output frequency of this mixer does not appear at the output.

Moreover, the overall operating point can be adjusted to the balance point (carrier null point) by the adjustable resistor.

9. TX (transmitter) Final Stage

This stage consists of Q306 to Q310 and Q312 as shown in the below block diagram.

The final stage is a power amplifier for 26.965 to 27.405 MHz RF signal as shown in Fig. 35.

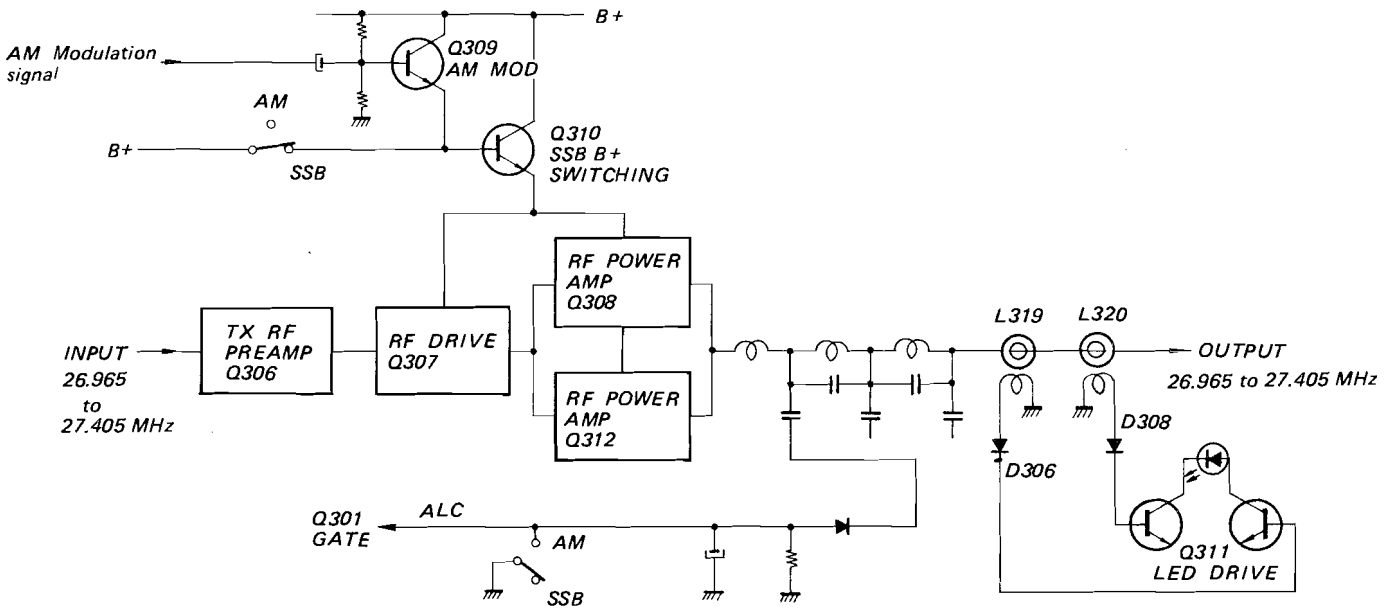


Fig. 35. Block diagram

(1) AM

B+ of the final power and driver transistors is supplied through Q309 and Q310. When with no modulation, the base bias of Q309 is much lower than the B+ voltage and the B+ voltage is supplied to Q307, 308 and 312 through Q310.

The amplitude modulation signal is input to the base of Q309. Q307, 308 and 312 are simultaneously collector-modulated. At this time, Q310 merely acts as a Darlington amplifier. At AM, ALC is turned OFF by means of the switch. The AM RF output is 4 W.

(2) SSB

When the base of Q310 is switched to a voltage higher than the base voltage of Q309 by means of the switch, the set is placed in the SSB state. Q309 is cut off and has no effect on operation. The ALC line services to limit the upper limit and distribute the suitable signal level on each stage, so that all the amplifiers, including the final power amplifier, are operated in the linear range.

(3) ALC (Automatic Level Control)

The ALC controls the input signal when a fixed output level has been reached. The purpose of the ALC is not to stabilize variations in the input level, but hold the distortion relative to excessive input level within permissible bounds.

At SSB transmission, the excessive input level takes the format of pulses because of voice operation. Therefore, ALC should be instantaneously operated. The short time from the generation of an excessive input level to the operation of ALC is called the "ALC rising time".

(4) ALC holding time

The time from suppression of the gain by ALC to recovery of the gain is called the "holding time".

When ALC holding time is short . . . . .
Dynamic range of voice is suppressed.

When ALC holding time is long . . . . .
Low input immediately after a high input is suppressed excessively.

Therefore, it is not best that the holding time is excessively long or short. The ALC holding time does not depend on the CR time constant of ALC generating, but is determined by controlling the gain of a variable gain amplifier (Q301 of frequency converter) by means of the ALC voltage.

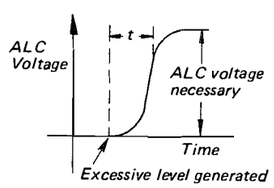


Fig. 36. ALC rise time

(5) Output Power Display

D306, 308, L319 and 320 perform output power display.

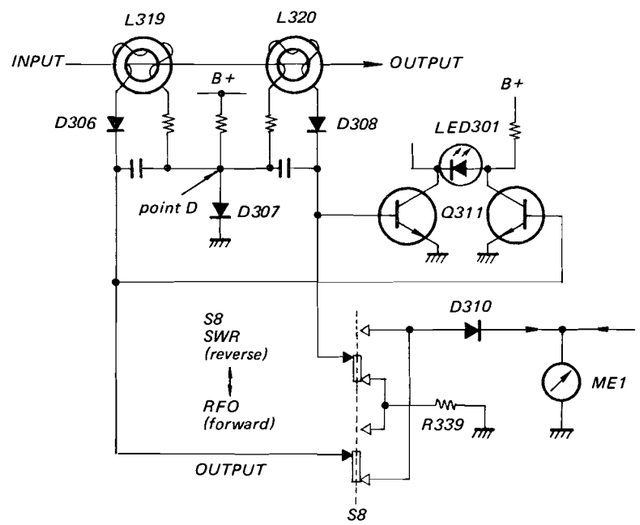


Fig. 37. Power display circuit

L319 and L320 are coils similar to an unshielded current transformer having 2.5 turns on each ring core. These form a compressed-shape directional coupler as shown in Fig. 38.

The directional coupler indicated at A is small.

Both coils are coupled by C and M to form a CM type power meter. It is important that the coils are facing to the opposite directions and the one at the left detects the forward power and the one at the right detects the reverse.

The value of R (510 Ω) in Fig. 38 has an effect on the extraction of directional power and varies with the value of M and C, etc. and is 510 Ω in this set.

It is easy to handle to indicating the forward and the reverse direction power as a ratio. Therefore, the connections are such that the forward and reverse voltages at point D of D307 lower the operating point in the (–) direction. The reverse direction power can be displayed as a ratio at any output level in this manner.

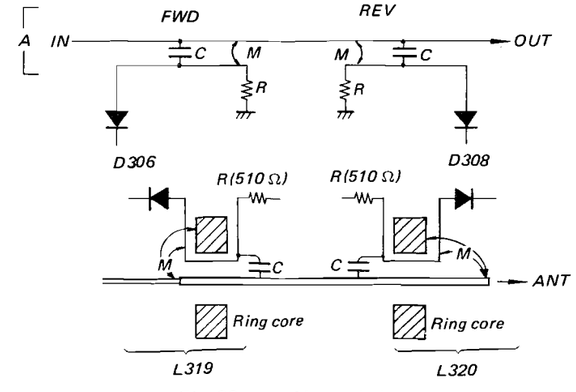


Fig. 38. CM coupled

10. Receiver Section

The main section consists of Q601 – 607 and 623 and the receiver section consists of Q601 – 623 including the auxiliary circuit.

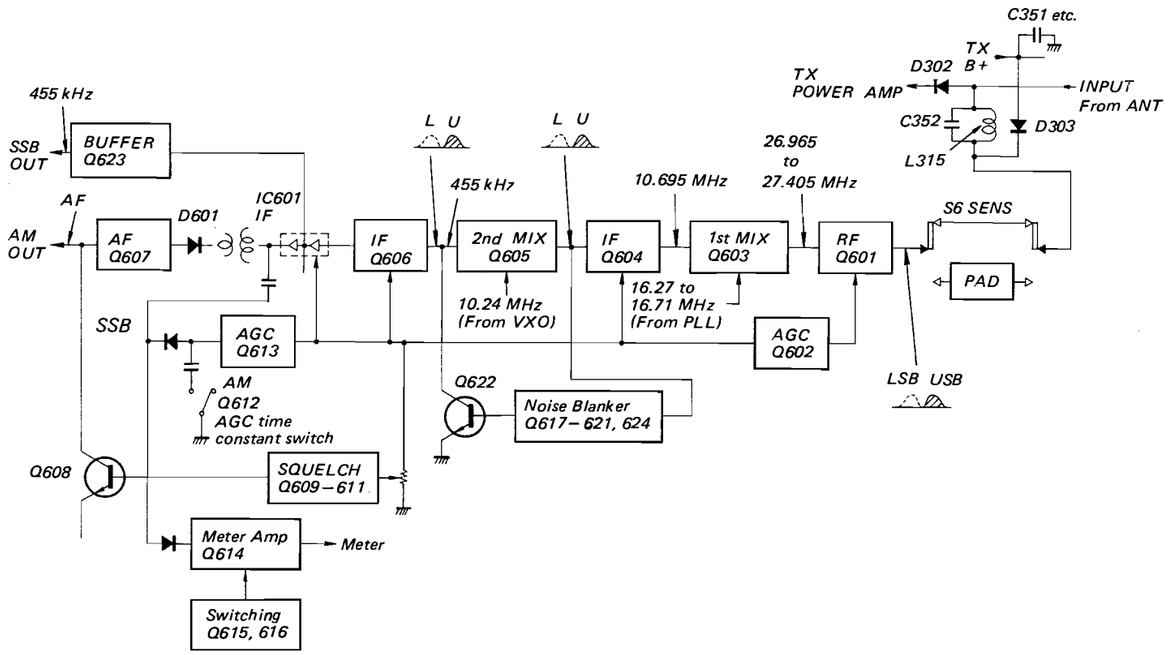


Fig. 39. Block diagram

(1) Receiver Circuit

The signal is received at the antenna switched from transmitting use to receiving use.

B+ voltage of TX is turned OFF and both D302 and D303 are also turned OFF. (Final stage is uncoupled and input is open) The signal enters the receiving section through the SENS switch (S6). Mixing the local oscillator signals, the 10.695 MHz IF is produced and a 455 kHz signal is output.

(2) Transmitting

B+ voltage for TX turns D303 and D302 ON. D302 connects the antenna to the TX final stage and D303 grounds signal leakage to the receiver section. B+ of the receiver section is turned OFF and the receiver section is not operated.

(3) AM reception

All the transistors except for Q615, 616 and 612 are operated and the output is detected by D601 and sent out through Q607.

(4) SSB reception

At SSB, the AGC attack time is not changed, but a capacitor is added to the AGC circuit by switch Q612 so that the release time is made long. Moreover, the signal is sent from IC601 to the SSB demodulator circuit through SSB buffer Q623. Squelch is not operated at SSB.

(5) Squelch

A part of the DC voltage of AGC is amplified and converted to a switching voltage by the comparator consisting of Q610 and 611 and is used to switch the AM AF amplifier. The switch is Q608. As shown in Fig. 40, when the emitter potential of the amplifier transistor Q607 exceeds its base potential, Q607 turns OFF.

The squelch level is varied by the VR2 (SQUELCH) resistor which divides the AGC voltage.

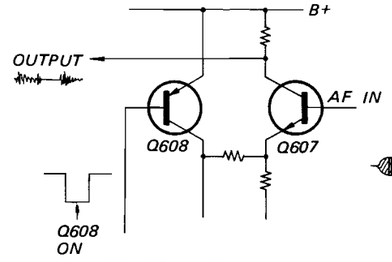


Fig. 40. Squelch

(6) Noise Blanker

The noise blanker switches the 455 kHz signal with the 1st IF 10.695 MHz as the input. A 10.695 MHz amplifier is provided and only the pulse input component is extracted at Q621.

The base of gate Q622 is driven by the DC component of this signal and pulse noise on the 455 kHz output signal of Q605 is removed.

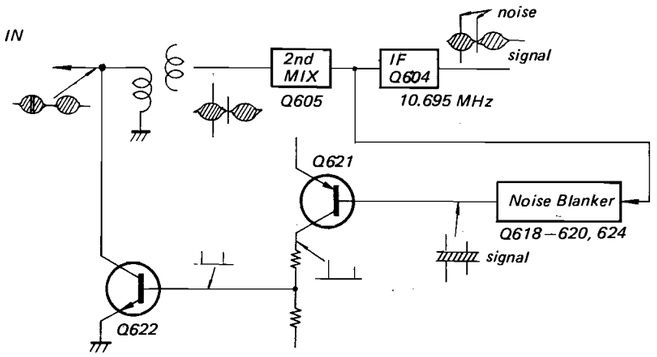


Fig. 41. Noise blanker

(7) Meter Amplifier Circuit

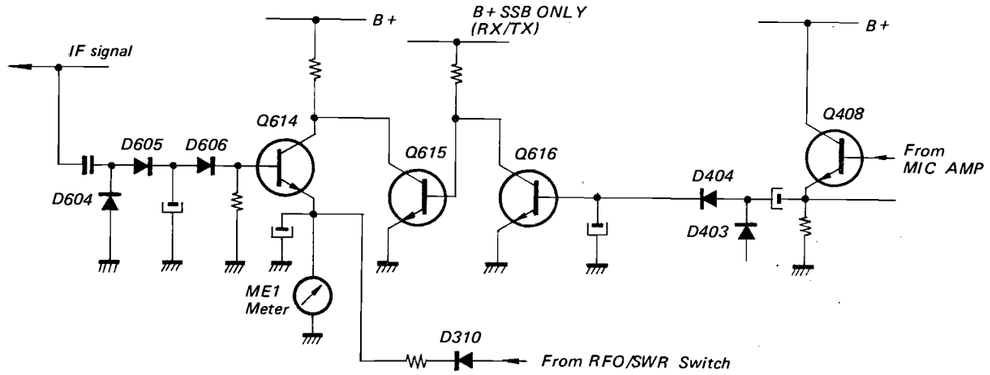


Fig. 42. Meter amp

11. SSB Demodulation

The part, used as the SSB generator at transmitting, is used as a demodulator. As shown in Fig. 43, the SSB generator section is arranged in the order in which it is connected at demodulation.

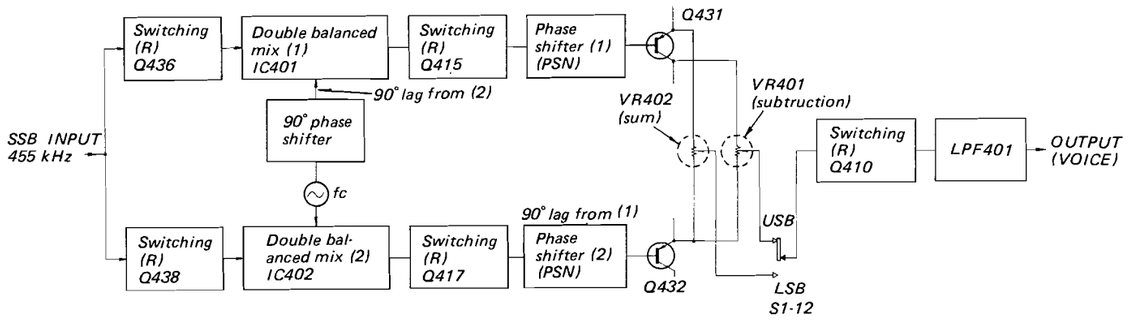


Fig. 43. Block diagram

(1) LSB reception

The LSB signal (input frequency lower than the carrier frequency fc) is input to the two demodulators (IC401 and 402) through the switching gate and two LSB signals appear as the output.

Both LSB signals are the same amplitude and same frequency, and the phase at the output of IC402 leads the phase at the output of IC401 by 90°. Since this is delayed 90° by phase shifter (2), both outputs become the same phase at the output of PSN and this output is extracted as the LSB output at the sum circuit.

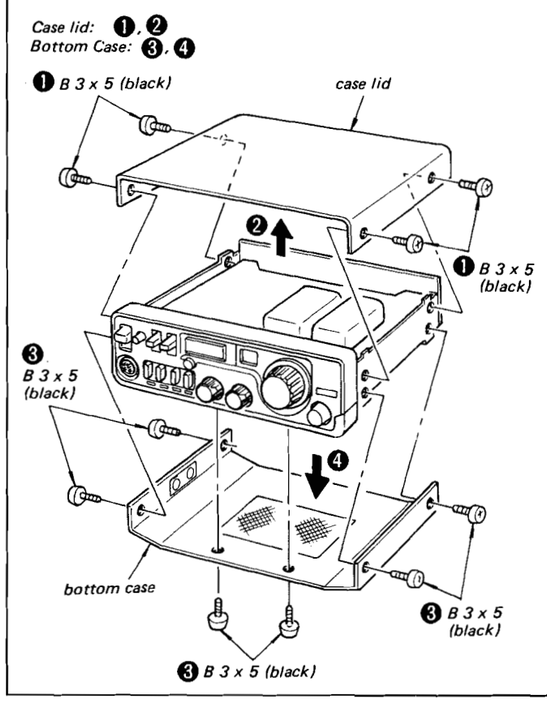
(2) USB reception

At USB reception, the phase at the output of IC402 legs the phase at the output of IC401 by 90°. Moreover, this 90° lagging signal is delayed 90° by phase shifter (2) and both outputs become the opposite phase at the output of the PSN. The polarity of one of these outputs is inverted by the subtraction circuit and the subtracted signal is extracted as the USB output.

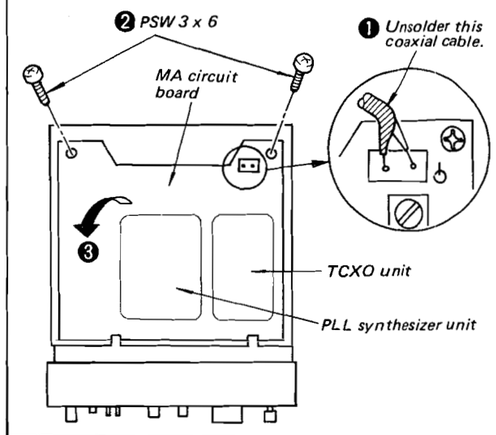
As the above descriptions, LSB and USB are compared with the carrier fc and appear as voice at the sum or subtraction circuit depending on whether the input signal frequency is higher or lower than the carrier frequency.

SECTION 2
DISASSEMBLY

CASE REMOVAL



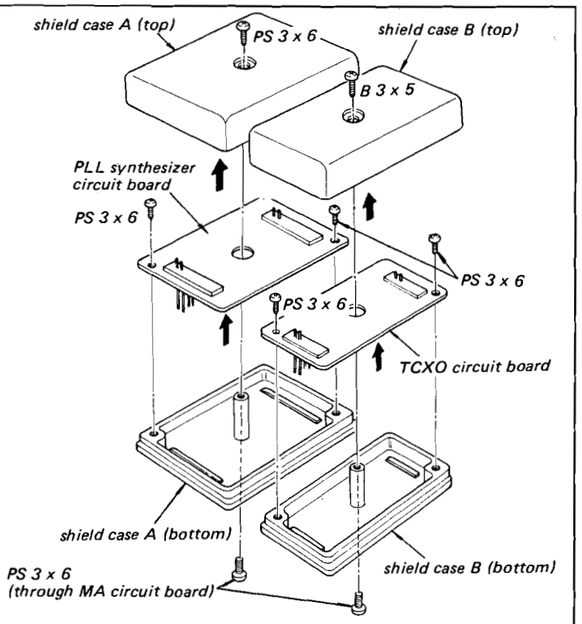
MA CIRCUIT BOARD REMOVAL



PLL SYNTHESIZER UNIT and TCXO UNIT REMOVAL

Note:

1. Do not repair the TCXO board. If the TCXO board is repaired, it is very difficult to maintain its thermal-compensation performance.
2. Do not move components on the TCXO board, especially the positive-curve thermistor which is touching the crystal.
3. The PLL synthesizer board can be repaired. However, the conductor side of the board is not accesible and cannot be checked during a check because of the shield case A.



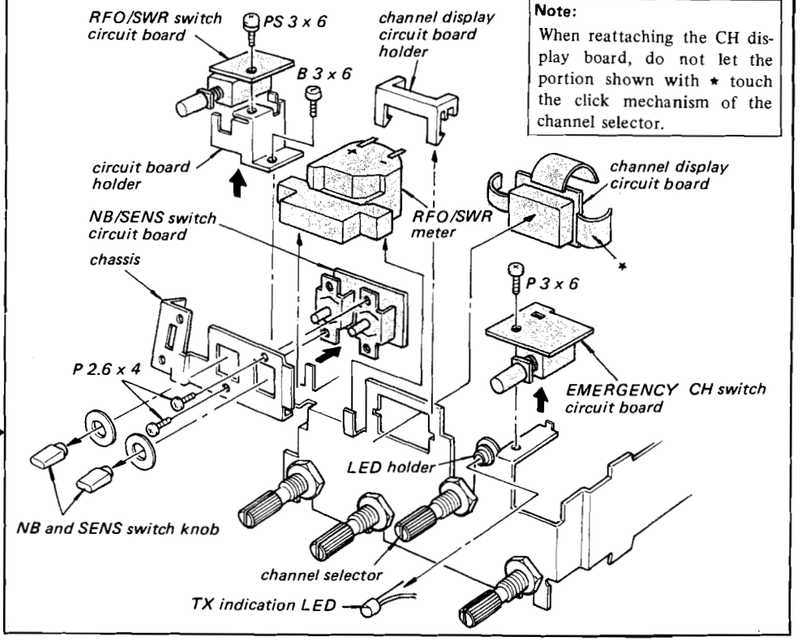
SPEAKER REMOVAL

Remove the speaker from the speaker holder.

→ To MB CIRCUIT BOARD and PSN CIRCUIT BOARD REMOVAL

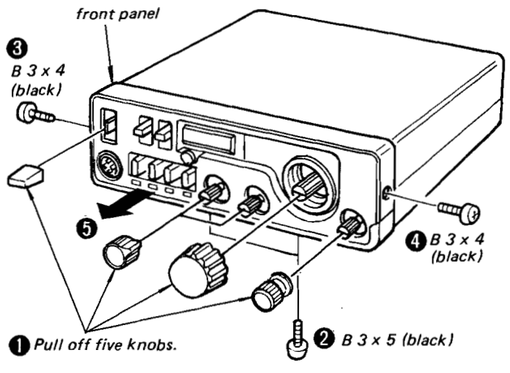
EMERGENCY CH SWITCH, NB/SENS SWITCH, RFO/SWR SWITCH, CHANNEL DISPLAY CIRCUIT BOARDS and METER REMOVAL

Note:
When reattaching the CH display board, do not let the portion shown with ★ touch the click mechanism of the channel selector.



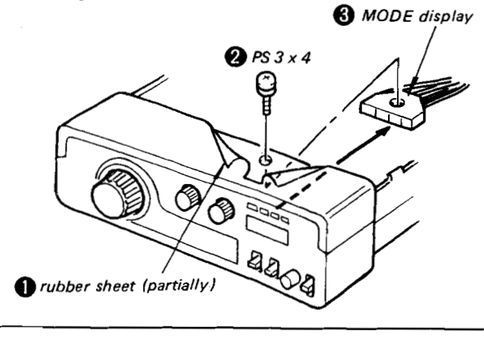
FRONT PANEL REMOVAL

Note: The front panel has MIC connector and pilot lamps mounted on it, and the front panel can be removed forward about 10 cm (4 inches).



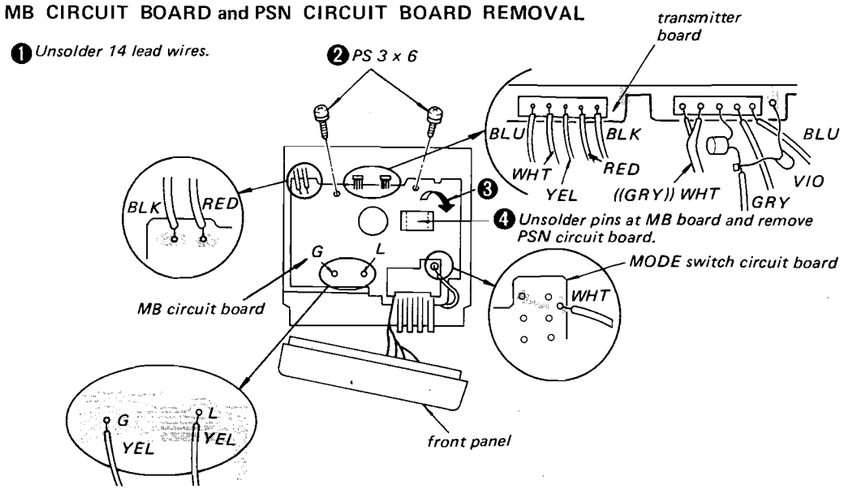
MODE DISPLAY REMOVAL

Note: When removing the screw, do not push it down. Do not remove the rubber sheet completely except when a rubber sheet replacement is required.

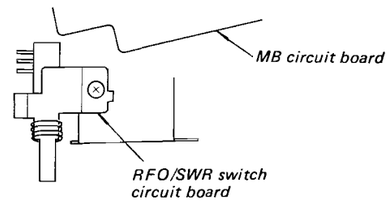


From SPEAKER REMOVAL

MB CIRCUIT BOARD and PSN CIRCUIT BOARD REMOVAL



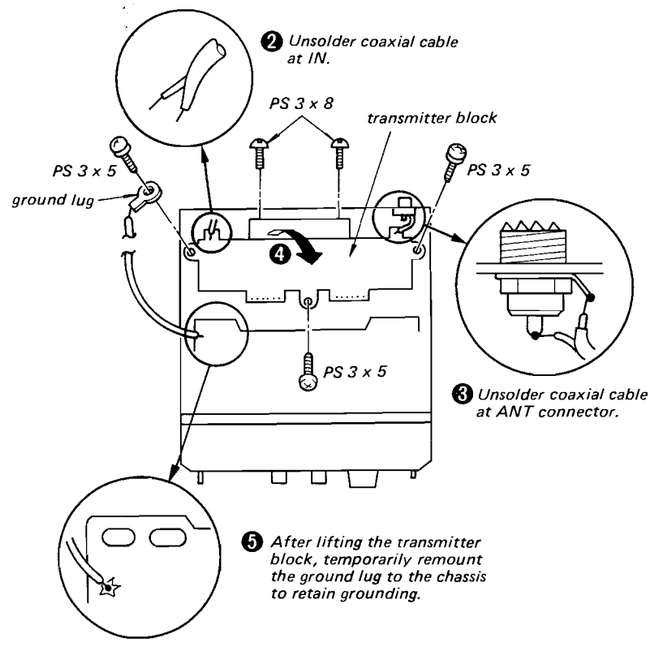
RFO/SWR SWITCH CIRCUIT BOARD REMOVAL

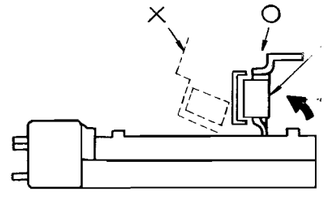


TRANSMITTER BLOCK REMOVAL

Note: If the lead wires of the speaker jacks interrupt the transmitter block removal, temporarily loosen the speaker-jack nuts.

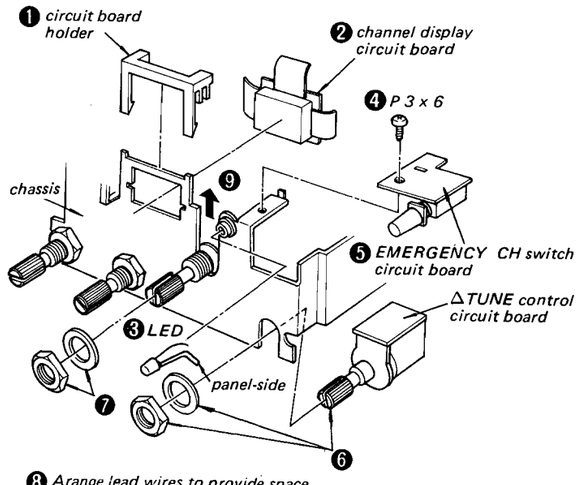
❶ *Remove five screws.*



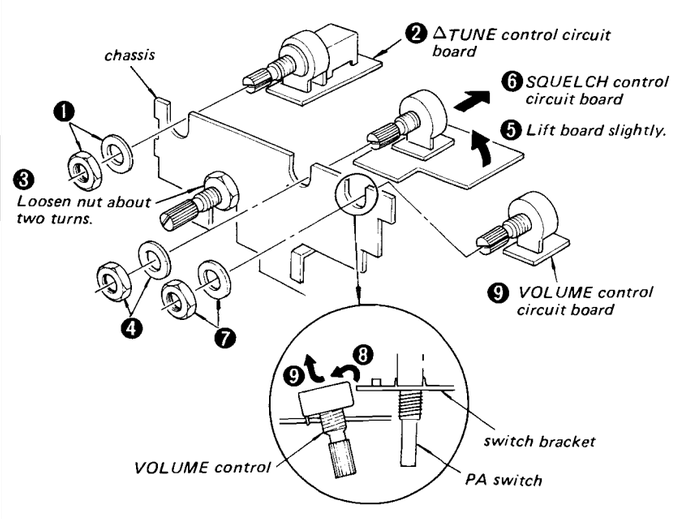


CHANNEL SELECTOR CIRCUIT BOARD REMOVAL

Note: It is rather difficult to remove this board. It is better to check the board as it is mounted on the chassis. If any defective diodes or resistors are detected, dissolve the soldered portions of them and push their leads toward the component side to remove from the circuit board. Next install new parts on the conductor side. After the parts replacement, completely pick the removed parts.



ΔTUNE, SQUELCH and VOLUME CONTROL CIRCUIT BOARD REMOVAL



SECTION 3
ADJUSTMENTS

Setting:

Unless otherwise specified, set the switches as follows.

POWER switch:	ON
NB switch:	OFF
Channel selector:	18
SENSE switch:	DX
PRESELECT CH:	OFF
EMERGENCY CH:	OFF
transmit/receive:	receive
Power supply voltage:	13.8 V

Test Equipment Required:

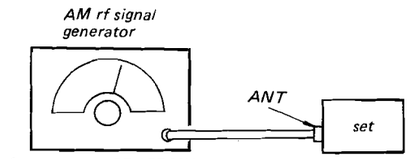
- Rf signal generator (AM)
- Regulated dc power supply (13.8 V, 3 A)
- Rf dummy load (non-inductive 50 Ω, more than 10 W)
- Oscilloscope (30 MHz, with triggered CH1 only provision)
- Sweep generator (30 MHz)
- In-line rf power/SWR meter (50 Ω, more than 10 W, 50 MHz)
- Frequency counter (30 MHz, sensitivity 50 mV)
- Audio signal generator (with attenuator down to 60 dB)
- Audio millivoltmeter
- Coaxial cable assemblies (50 Ω, less than one foot, fitted with plugs)

Note on Adjustment

1. TX means transmitter
   RX means receiver
2. Unless otherwise specified, input levels are to be as low as possible for the adjustments.
3. The maximum current drain in transmitting is about 2A. A regulated dc power supply of 2A is insufficient. Use a power supply of 3A or more.
4. The coaxial cables used for connecting the ANT connector and the power meter, and the power meter to the dummy load are to be as short as possible. If the cables are long, SWR indication becomes different from the true value due to the cable loss.
5. It is preferable to use a low-capacitive probe with the frequency counter not to interrupt the circuit connected. If such a probe is not available, precisely follow the procedure in this manual.
6. The frequencies 10.24 MHz, 10.70 MHz, 16.27 – 16.71 MHz which appear in the appropriate adjustment are rather close frequencies than those of 455 kHz and 27 MHz. Be careful not to choose an incorrect frequency in the adjustments.
7. AGC and ALC loops are employed in the audio amp, TCXO and from the transmitter frequency converter to the power amp. If these loops are cut during the level measurements, correct measurements can not be made. For example, if B+ to the transmitter power amp stage is cut and the set is placed in the transmit mode, ALC voltage is absent in the transmitter power amp stage and the younger stages of the transmitter becomes in high-gain condition resulting in an abnormal level distribution.
8. Select a particular channel for testing the set, because the operation of each section of the phase-locked loop (PLL) frequency synthesizer completely changes when the channel is changed. In the circuit diagram, CH 21 is shown. This is because this channel is about the center of all the 40 channels and the channel selectors of the first and second digits are contacting.

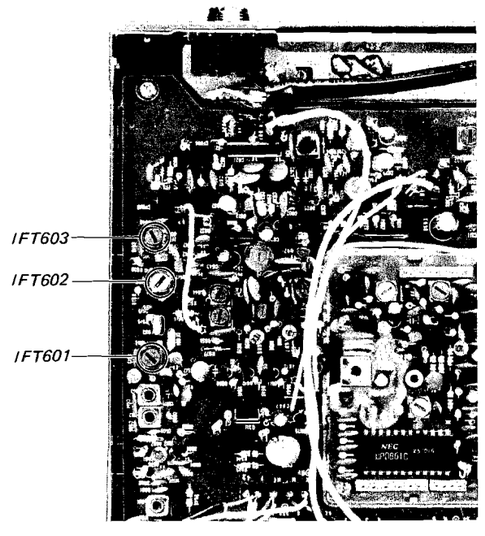
RX IF Adjustment

Procedure:



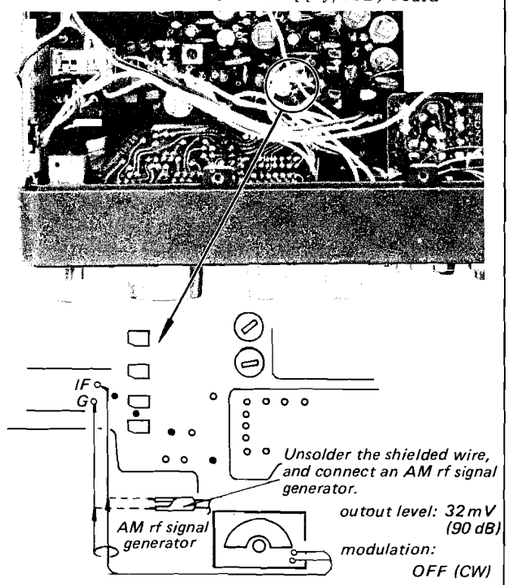
Adjust IFT601, IFT602 and IFT603 for a maximum 1 kHz sound from the speaker.

Adjustment Location:
– MA board –



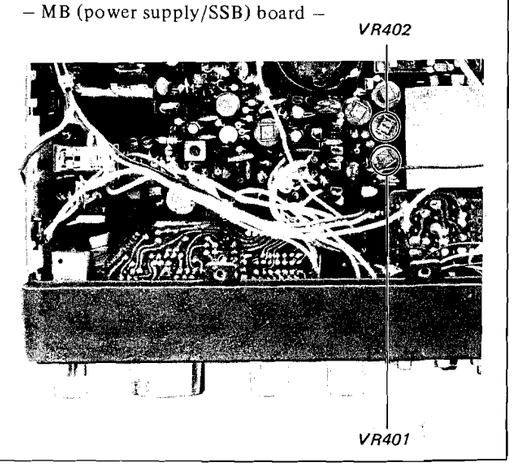
RX Sideband Suppression Adjustment

Procedure:



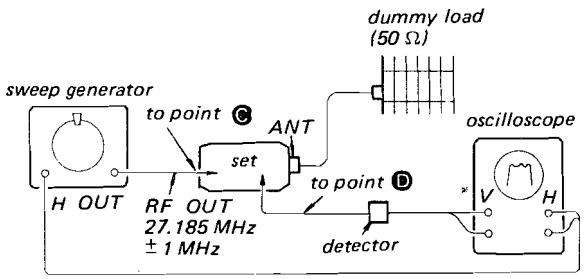
1. MODE siwtch: LSB
   Set the dial of AM rf signal generator to 456 kHz. Adjust VR402 for a minimum audio output from the speaker.
2. MODE switch: USB
   Set the dial of AM rf signal generator to 454 kHz. Adjust VR401 for a minimum audio output from the speaker.

Adjustment Location:
– MB (power supply/SSB) board –

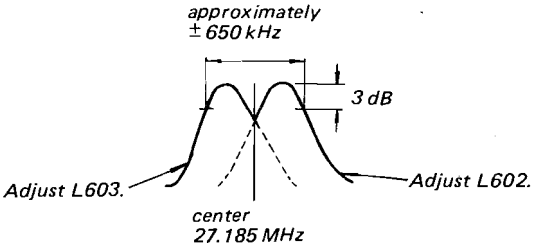


RX 27 MHz Bandpass Adjustment

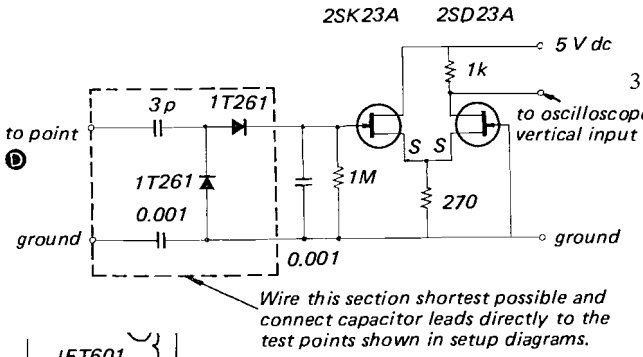
Procedure:



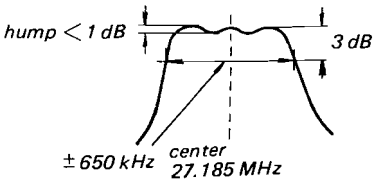
1. Adjust the output level of the sweep generator to a lowest possible to obtain a swept waveform on the oscilloscope.
2. Loosen the core of L601. Adjust L602 and L603 for a waveform shown below.



Circuit Diagram of Detector

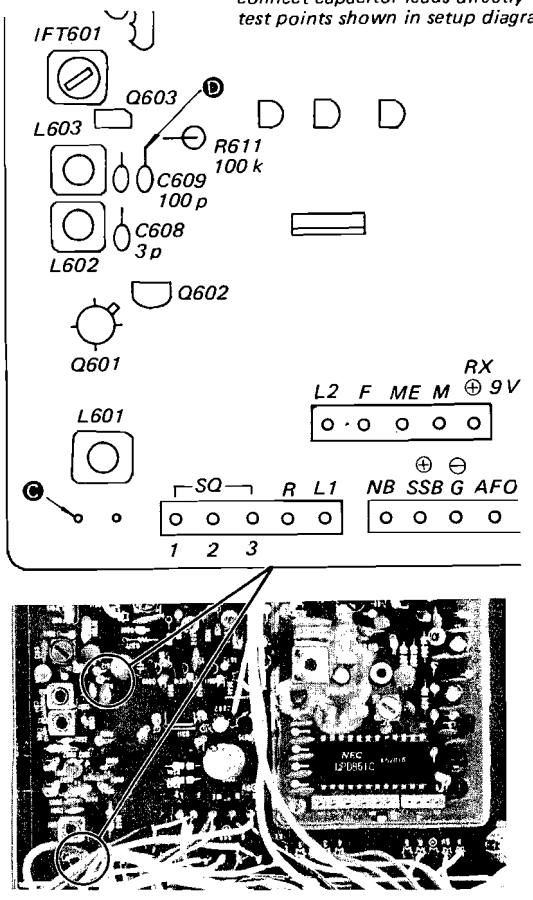


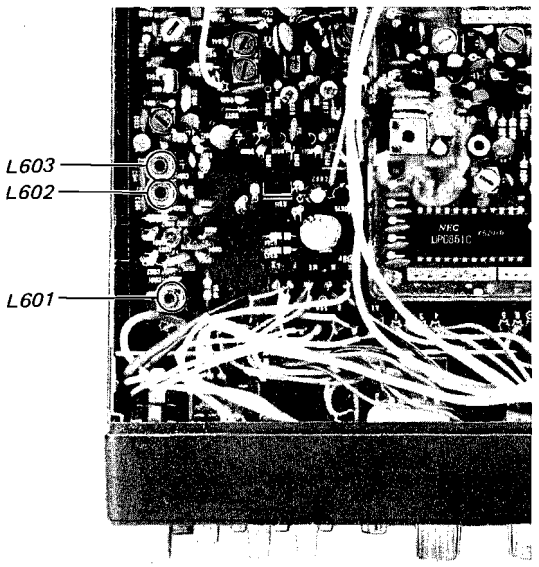
3. Adjust L601 to tune to 27.185 MHz for a waveform shown below.



Adjustment Location:

– MA board –



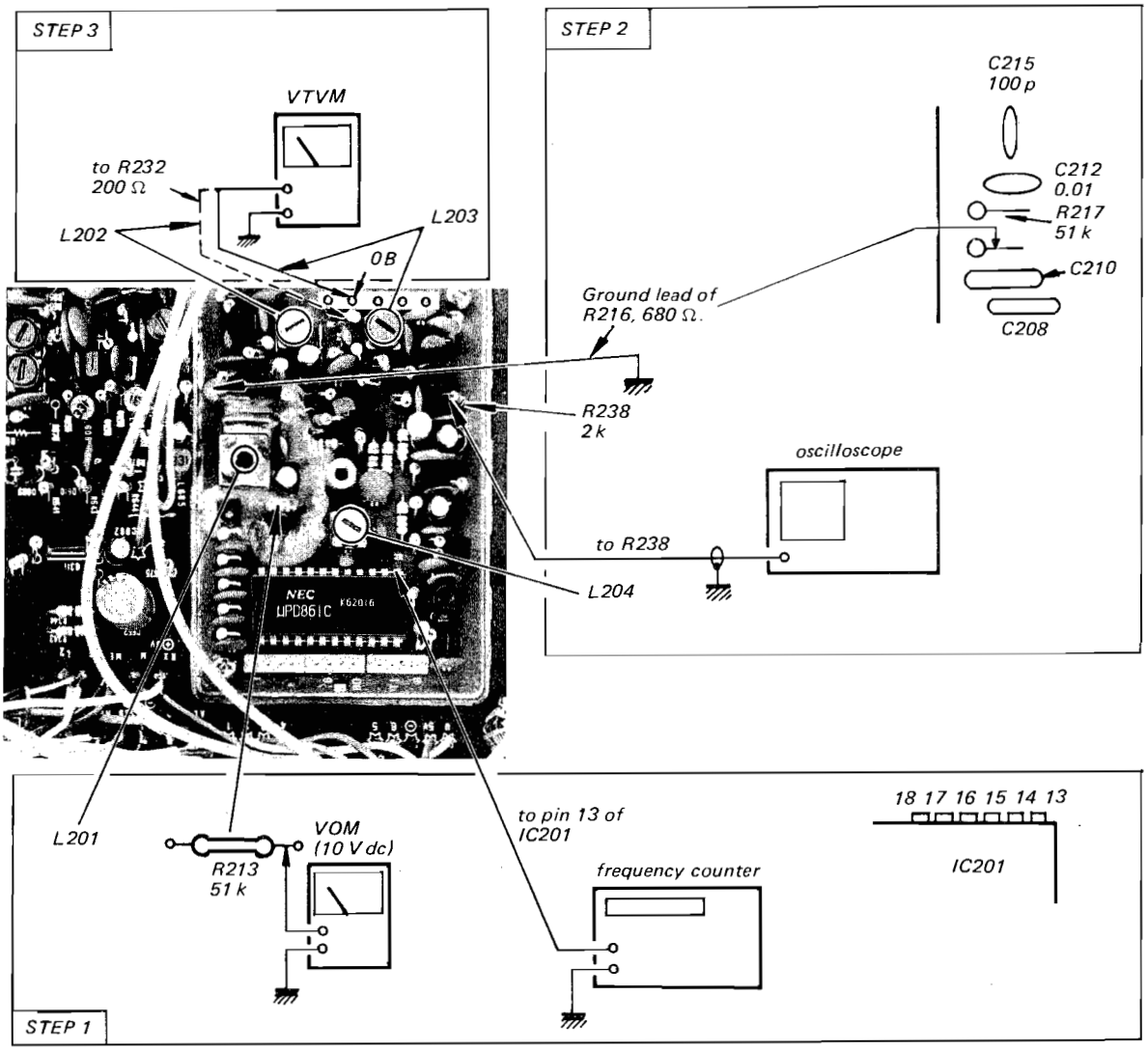


– MA board –

PLL Synthesizer Adjustment

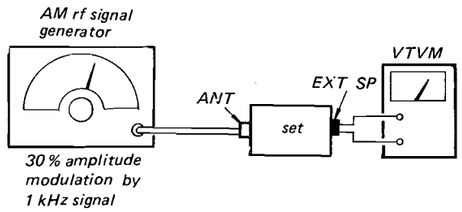
1. Channel selector: 1, 40
   Set the channel selector to 1. Adjust L201 for a 1 V dc reading on VOM. The frequency counter reading should be 910 kHz.
   Set the channel selector to 40. Now VOM should read 2.7 – 3.2 V dc, and the frequency counter should read 1,350 kHz.
2. Channel selector: 40
   Short the emitter of Q202 to ground and stop the oscillation. Adjust L204 for a maximum 15.36 MHz signal reading (approximately 0.3 Vp-p) on the oscilloscope.
3. Channel selector: 18
   Adjust L202 and L203 for maximum readings on VTVM.

– SYNTHESIZER board –

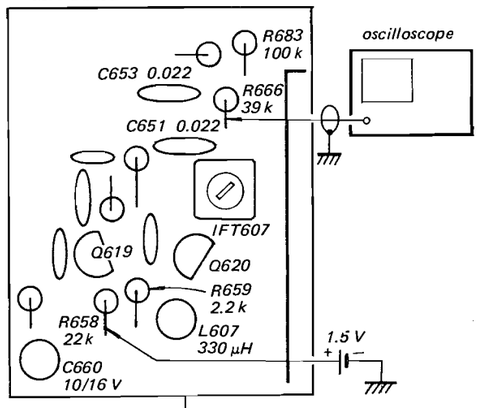


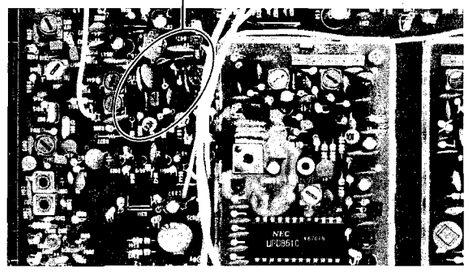
NB Adjustment (1)

Procedure:



– MA board –

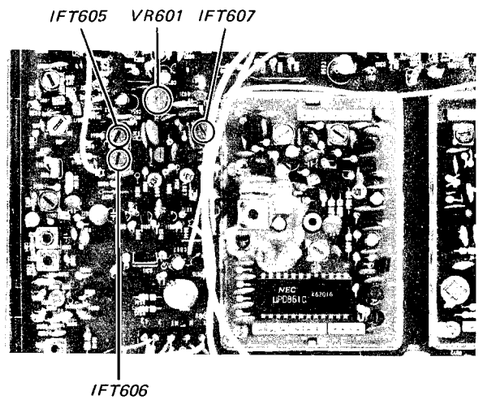




1. NB switch: ON
   Output level of rf signal generator: 100 µV (40 dB)
   Adjust IFT605, IFT606 and IFT607 for a maximum reading (455 kHz) on the oscilloscope.
2. Output level of rf signal generator: 1 µV (0 dB)
   Adjust and set VR601 to the point where the audio output level at EXT SP just starts to drop.
3. NB switch: OFF
   Receive an ignition noise radiated from automobiles. Turn NB switch ON and check that the ignition noise reduces.

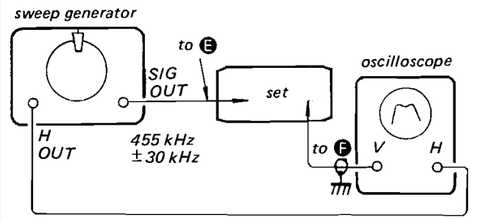
Adjustment Location:

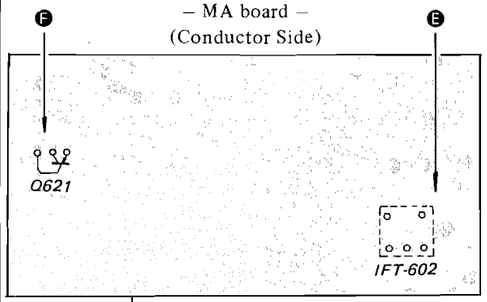
– MA board –

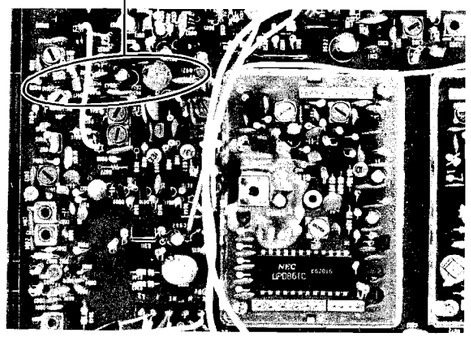


NB Adjustment (2)

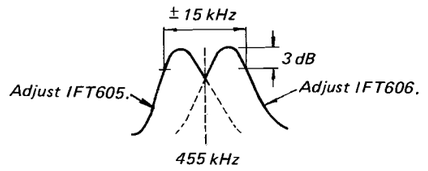
Procedure:



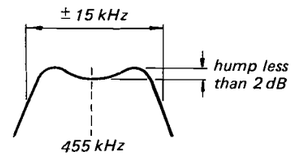




1. Loosen the core of IFT607. Adjust IFT605 and IFT606 for a waveform shown below.

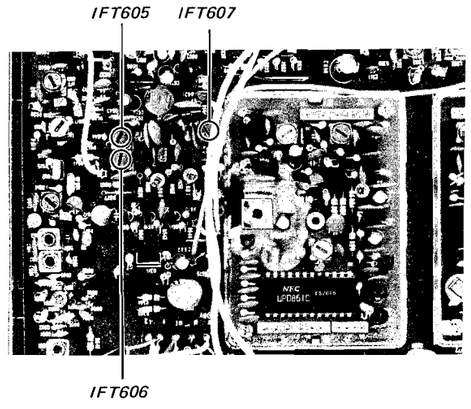


2. Adjust IFT607 to tune to 455 kHz for a waveform shown below.



Adjustment Location:

– MA board –

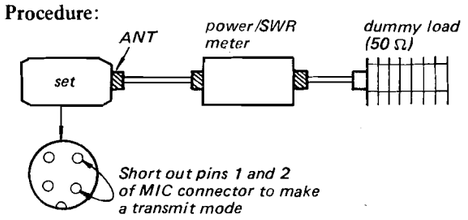


TX AM Output Power Adjustment

Setting:

MODE switch: AM
transmit/receive: transmit

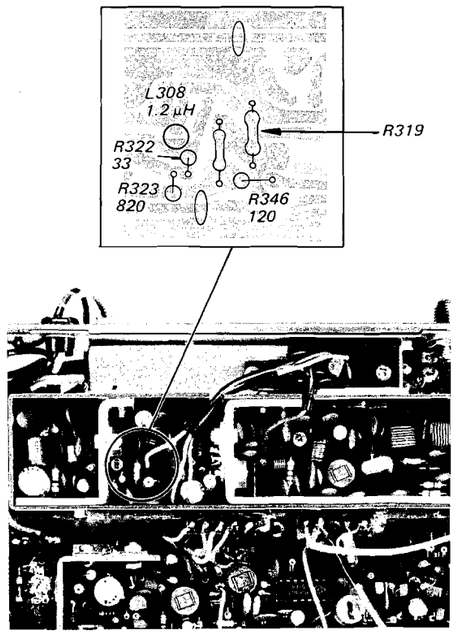
Procedure:



Adjust R319 for 3.4 W reading on the power/SWR meter.
When the value of R319 is reduced, output power reduces. (When the power/SWR meter is not available, connect an oscilloscope across the 50 Ω dummy load and adjust R319 for 36.76 Vp-p reading on the oscilloscope.)

Specification: 3.4 W ± 0.2 W

Adjustment Location:
– TRANSMITTER board –

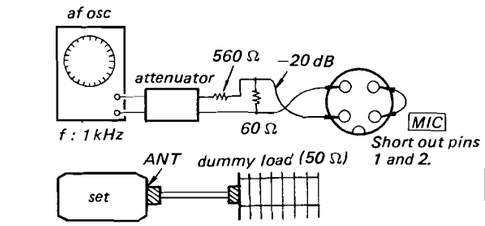


TX AM Modulation Adjustment

Setting:

MODE switch: AM
transmit/receive: transmit

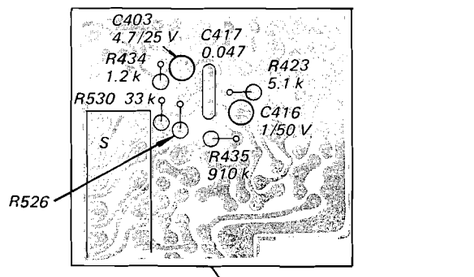
Procedure:

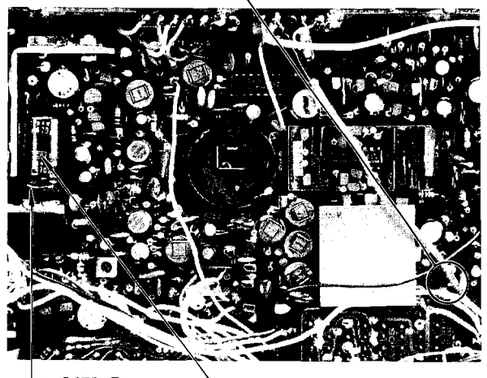


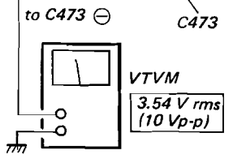
Adjust R526 for the indicated VTVM reading.

Specification: $3.54\ V\ ^{+0}_{-0.36}$ V rms

Adjustment Location:
– MB (power supply/SSB) board –





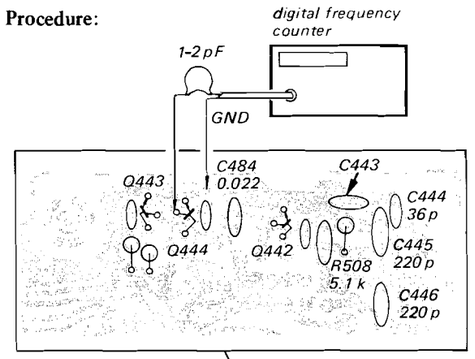


TX 455 kHz Osc Adjustment

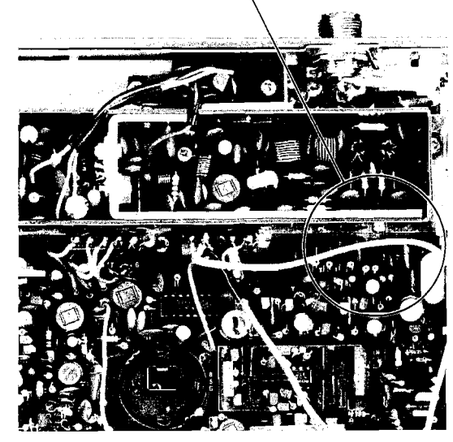
Setting:

MODE switch: LSB
transmit/receive: transmit

Procedure:



– MB (power supply SSB) board –



Adjust C443 for 1.820 MHz reading on the frequency counter.

Value of C443	Frequency change
small ↑ large	up ↓ down

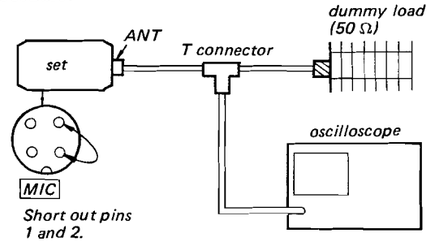
Specification: 1.820 MHz ± 15 Hz

TX SSB Carrier Suppression Adjustment

Setting:

transmit/receive: transmit

Procedure:

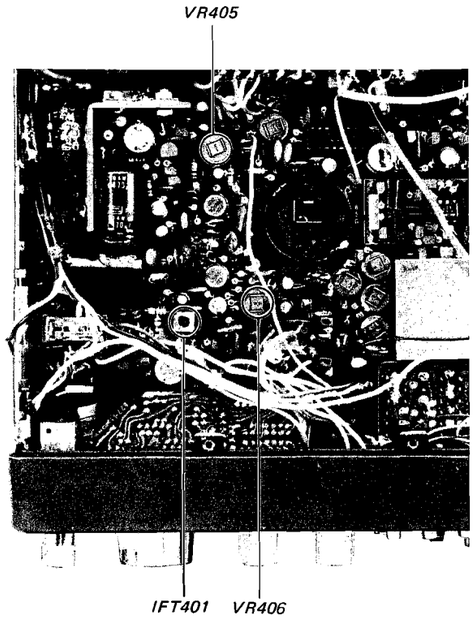


1 MODE switch: AM
Adjust IFT401 for a maximum reading on the oscilloscope.

2. MODE: USB
Adjust VR405 and VR406 for a minimum carrier reading on the oscilloscope.

Specification: more than 42 dB down from the reading of step 1.

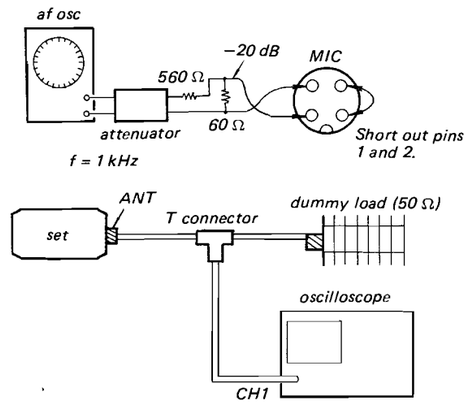
Adjustment Location:
– MB (power supply/SSB) board –



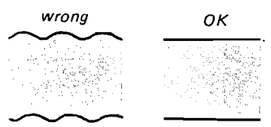
TX SSB Sideband Suppression Adjustment

Setting:
transmit/receive: transmit

Procedure:



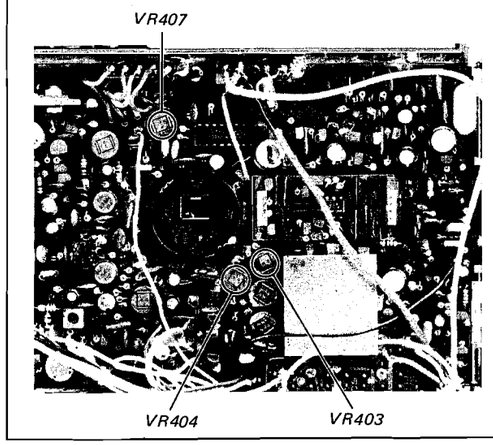
1. MODE: USB
   Adjust VR404 and VR407 for a pure CW waveform on the oscilloscope.



2. MODE: LSB
   Adjust VR403 for a pure CW waveform on the oscilloscope as in step 1.

Adjustment Location:

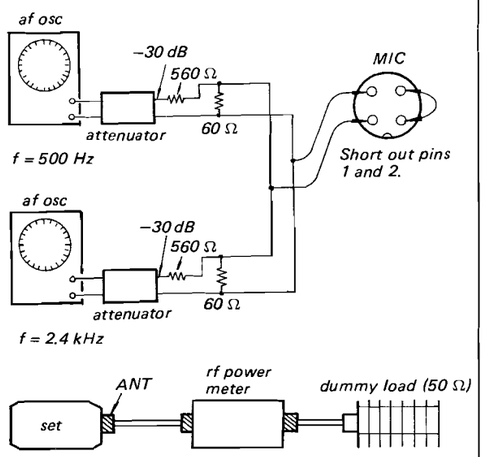
– MB (power supply/SSB) board –



TX ALC Adjustment

Setting:
MODE switch: USB
transmit/receiver: transmit

Procedure:



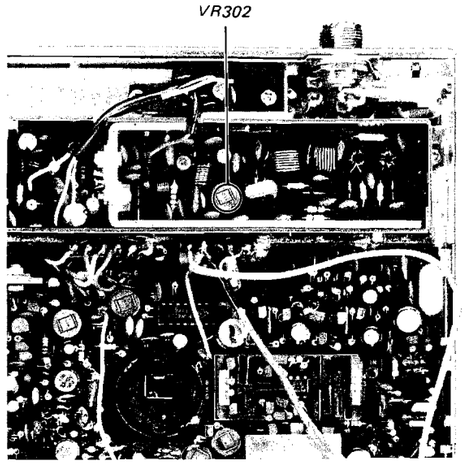
Note: CW-type rf power meter can be used, because the output power is not PEP (peak envelope power).

Reference data: third-order distortion is −27 dB or less

Adjust VR302 for a 5.2W reading on the rf power meter.

Adjustment Location:

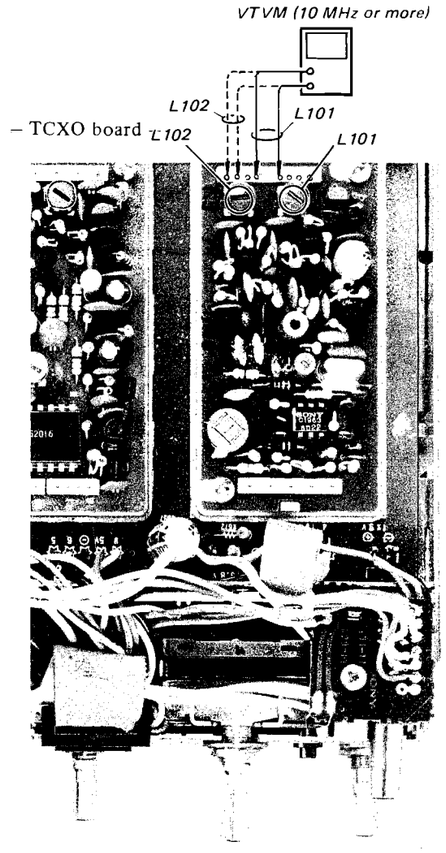
– TRANSMITTER board –



TCXO (VXO) Output Adjustment

Setting:
transmit/receive: transmit

Procedure:

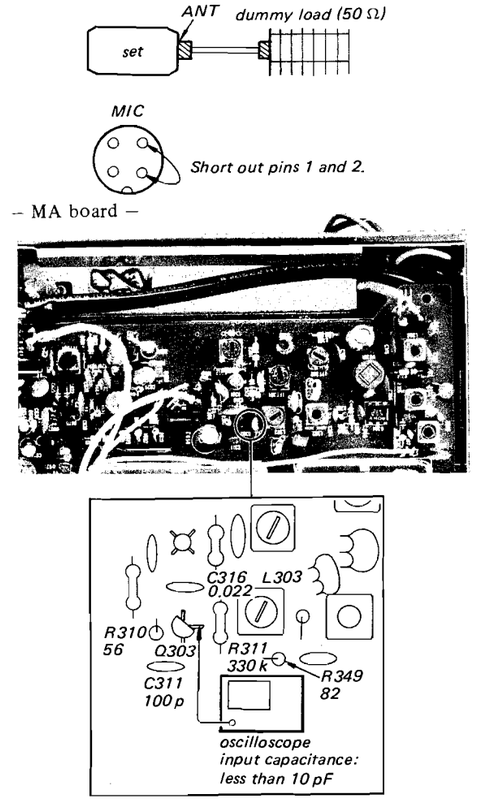


Adjust L101 and L102 for maximum readings on VTVM.

TX PLL Buffer Adjustment

Setting:
transmit/receive: transmit

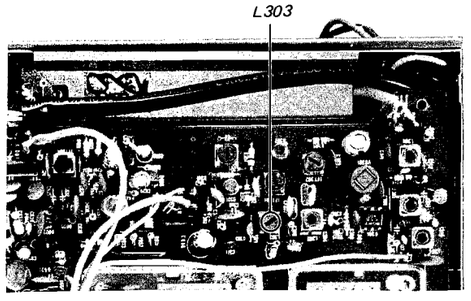
Procedure:



Adjust L303 for a maximum reading (16.480 MHz) on the oscilloscope.

Adjustment Location:

– MA board –

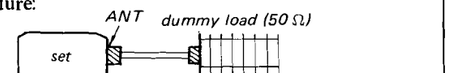


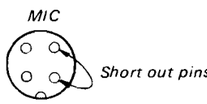
TX 455 kHz Buffer Adjustment

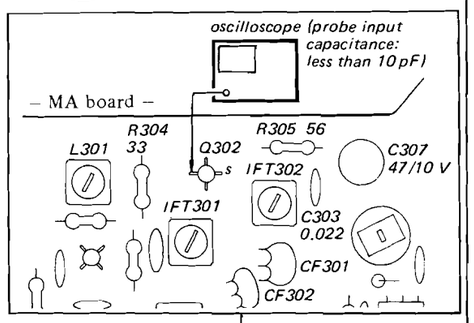
Setting:

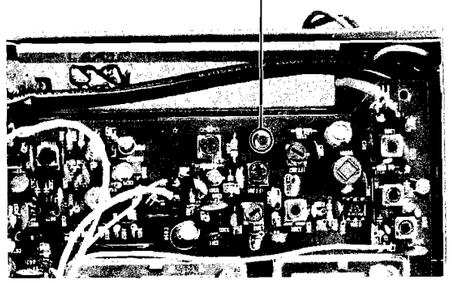
transmit/receive: transmit

Procedure:





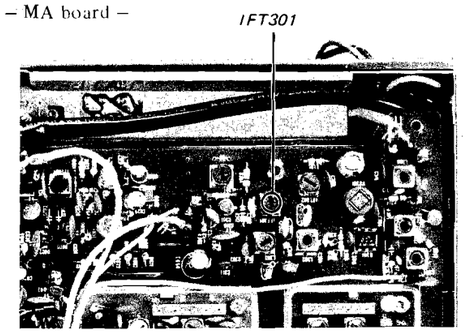




Adjust IFT301 for a maximum reading (455 kHz) on the oscilloscope.

Adjustment Location:

– MA board –

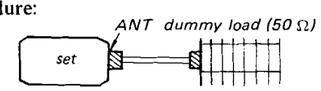


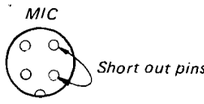
TX TCXO Injection Adjustment

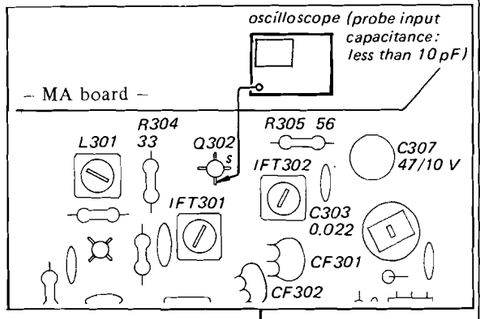
Setting:

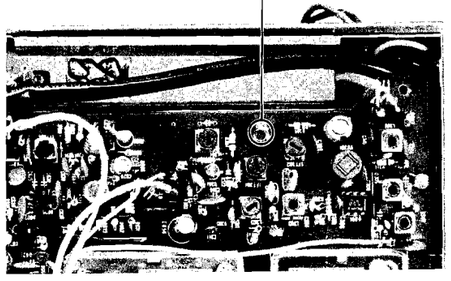
transmit/receive: transmit

Procedure:





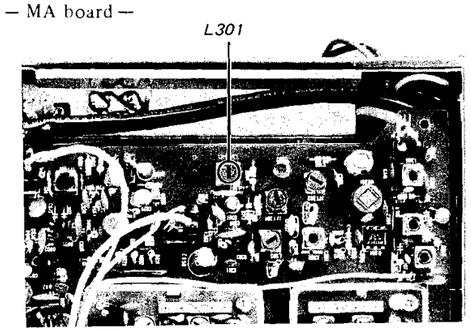




Adjust L301 for a maximum reading (10.24 MHz) on the oscilloscope.

Adjustment Location:

– MA board –

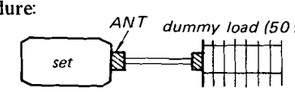


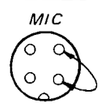
TX 10.695 MHz Amp Adjustment

Setting:

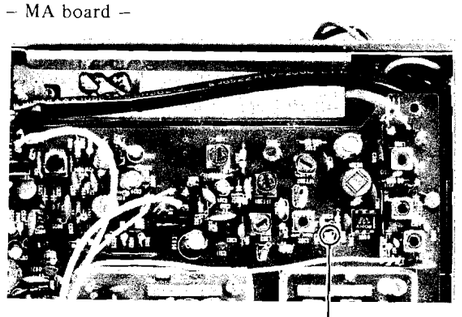
transmit/receive: transmit

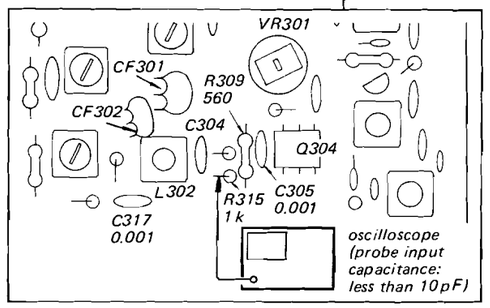
Procedure:





– MA board –

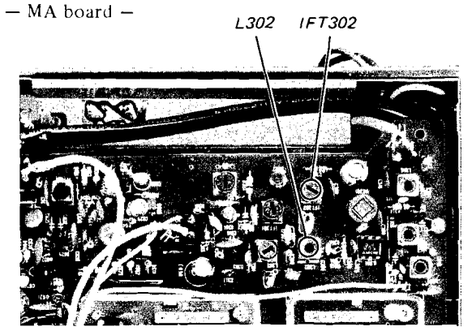




Adjust L302 and IFT302 for a maximum reading (10.695 MHz) on the oscilloscope.

Adjustment Location:

– MA board –

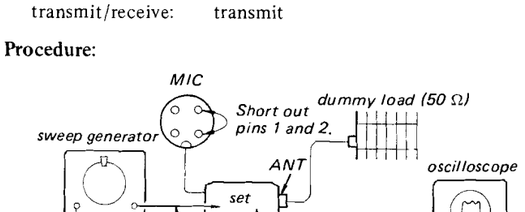


TX 27 MHz Bandpass Adjustment

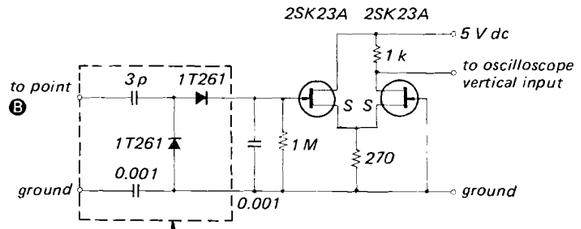
Setting:

transmit/receive: transmit

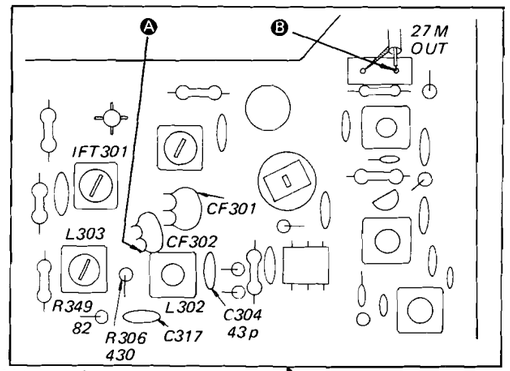
Procedure:



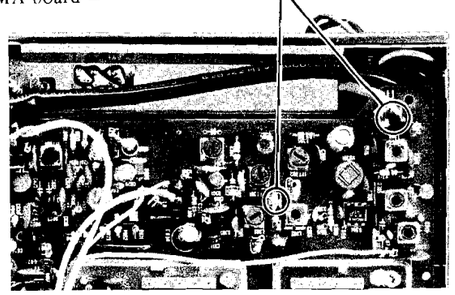
Circuit Diagram of Detector



Wire this section shortest possible and connect capacitor leads directly to the test points shown in setup diagrams.

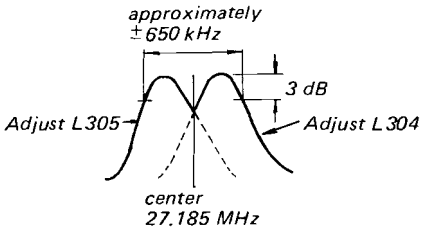


– MA board –

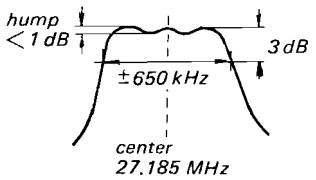


Note: In the circuit, 10.24 MHz and 16 MHz contents exist. However, neglect them for this adjustment.

1. Adjust the output level of the sweep generator to a lowest possible to obtain a swept waveform on the oscilloscope.
2. Loosen the core of L306. Adjust L304 and L305 for a waveform shown below.

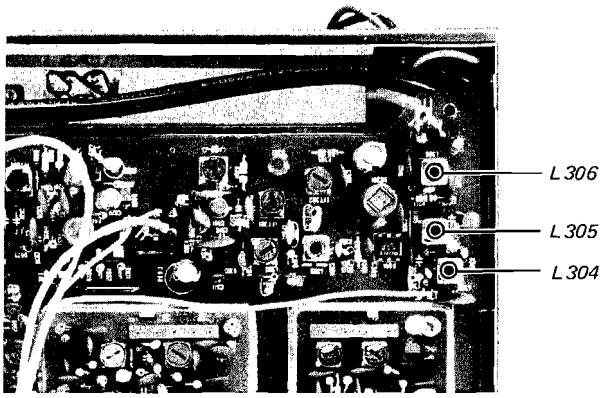


3. Adjust L306 to tune to 27.185 MHz for a waveform shown below.



Adjustment Location:

– MA board –



TX Spurious Response

2nd harmonic content:	less than −65 dB
3rd harmonic content:	less than −65 dB
legal value:	both less than −60 dB

To check the transmitter spurious response, a 100 MHz spectrum analyzer is needed.

SECTION 4

DIAGRAMS

4-1. MOUNTING DIAGRAM — Power Supply and SSB Generator Section; basic —

Note: (for schematic diagram)

- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000 Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2 % indicates component tolerance.
- △ : internal component.
- * : selected to yield optimum performance.
- ▬ : B+ bus.
- ▭ : panel designation.
- ▭ : adjustment for repair.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  Approx. 230 mA (RX AM)
  Approx. 230 mA (RX SSB)
  1.8 A ..... antenna load 50 Ω
  (TX AM, NO MODULATION)
  2.6 A ..... no antenna load
  (TX AM, NO MODULATION)
  780 mA (TX SSB, NO MODULATION)
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, S5 (NB) is on and VR2 (SQUELCH) is at maximum position.
  [ ]: TX AM
  ≪ ≫: TX SSB
- Relation between signal frequency and sweep time/cm of oscilloscope.

SIGNAL FREQUENCY	SWEEP TIME/CM
1 kHz	1 mSEC
10 kHz	0.1 mSEC
455 kHz	2.1 μSEC
1.16 MHz	0.62 μSEC (620 nSEC)
1.82 MHz	0.62 μSEC (620 nSEC)
3.64 MHz	0.27 μSEC (270 nSEC)
5.12 MHz	0.19 μSEC (190 nSEC)
10.24 MHz	97 nSEC
15.36 MHz	65 nSEC
16.52 MHz	60 nSEC
27.215 MHz	38 nSEC

- Signal waveforms are in RX AM (S6: DX) mode, when signal ..... 27.215 MHz 40 dB (1 kHz, 30% modulation) ..... is supplied at antenna, unless otherwise noted on the below table. The waveforms are indicated to show the circuit basically.

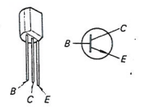
SECTION	MODE	CHANNEL	SIGNAL APPLIED	SIGNAL OBTAINED
TX FREQUENCY CONVERTER and TX POWER AMP	TX AM	21	———	———
RF AMP	RX AM	21	27.215 MHz 40 dB (1 kHz, 30 % modulation) at antenna	———
AM DET	RX LSB	21	27.215 MHz 40 dB (continuous wave) at antenna	1 kHz beat at speaker terminals
SSB demodulator and MIC AMP	RX LSB	———	454 kHz 40 mVp-p (continuous wave) at terminal (IF) in MB board	———
AF AMP	RX AM	21	27.215 MHz 40 dB (1 kHz, 30 % modulation) at antenna	1 Vp-p at speaker terminals
455 kHz OSC	RX LSB	———	———	———
VXO and PLL (Except for secondary waveforms of L101, L102 and L203)	RX AM	———	———	———

- For the details, see the schematic diagram in each mode (RX AM, RX SSB, TX AM or TX SSB).

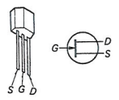
Replacement Semiconductors

For replacement, use semiconductors except in ( ).

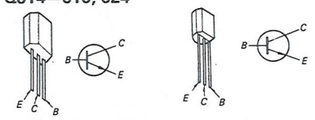
Q439, 440, 442, Q445, 446: 2SC710



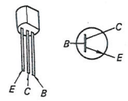
Q406: 2SK23A-824 (2SK23A)
Q429, 430: 2SK23A-812 (2SK23A)



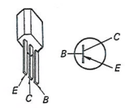
Q401, 403–405
Q407–410, 412–419
Q433, 435–438, 441
Q447, 454, 455, 460
Q602, 607, 609–612
Q614–616, 624
: 2SC634A (2SC1363)



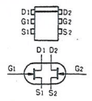
Q451, 456 ~459: 2SC1474



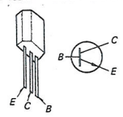
Q402, 420, 421, 427
Q428, 431, 432, 434
Q448–450
: 2SA678



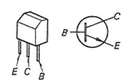
Q422: 2SK58



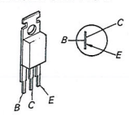
Q423–426: 2SC634A (2SC633)



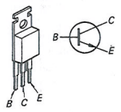
Q443, 444: 2SC641K (2SC641)



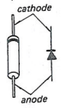
Q452: 2SA473



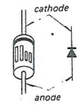
Q453: 2SC1173



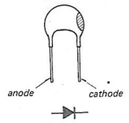
D310
D407–409, 415–419
D422
: 1S1555
D414, 420, 421: 10E2 (10E1)
D401–406: 1T22A (1T23)



D412: EQB01-09

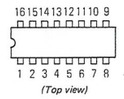


D410, 411: VD1120 (MV5H)

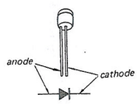


IC401, 402: μA796HC

IC403: MSM4027

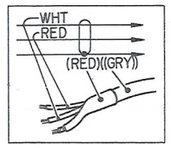


LED401–404: TLR109



Note:

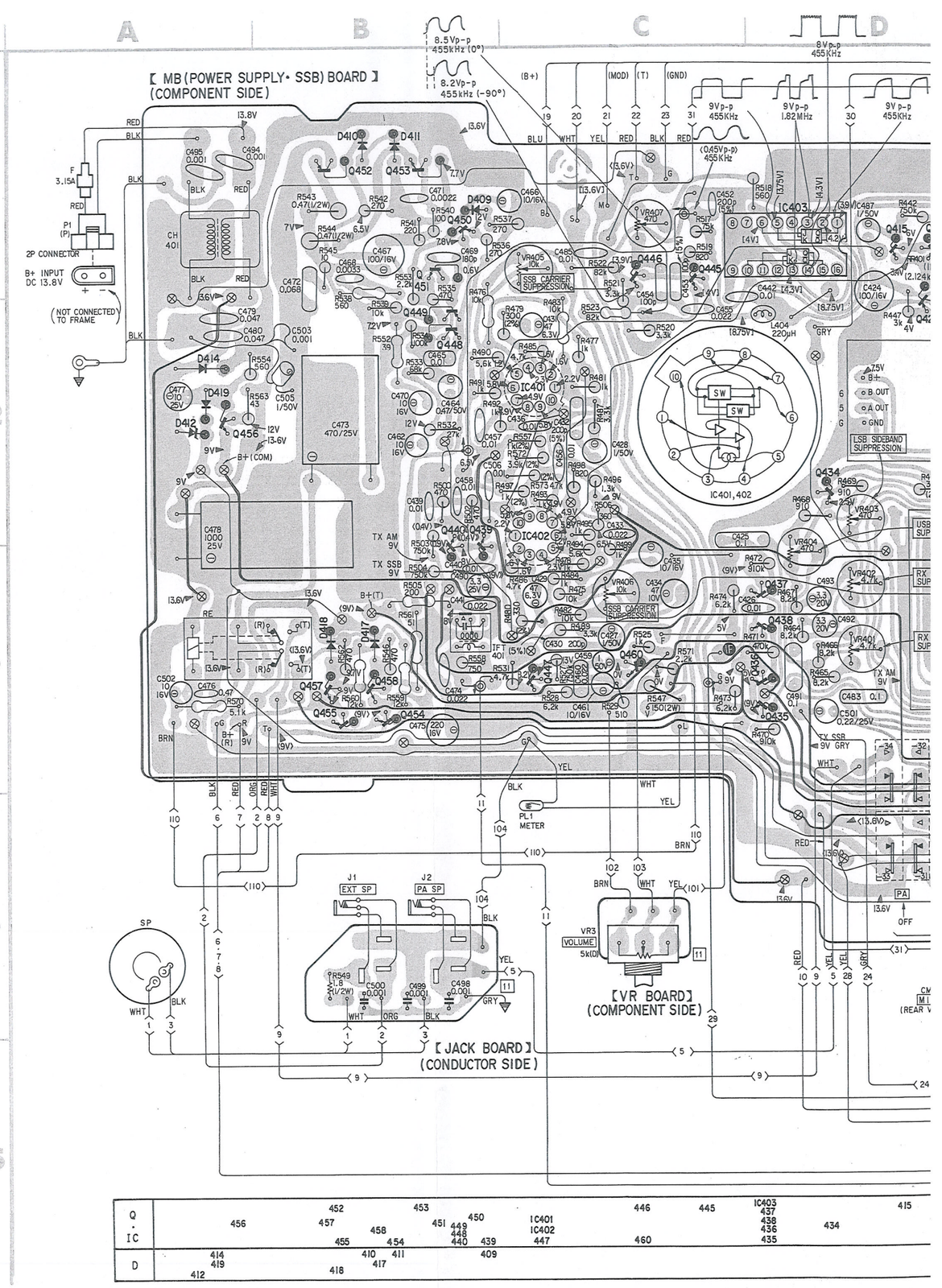
- Color code of sleeving over the end of the jacket.



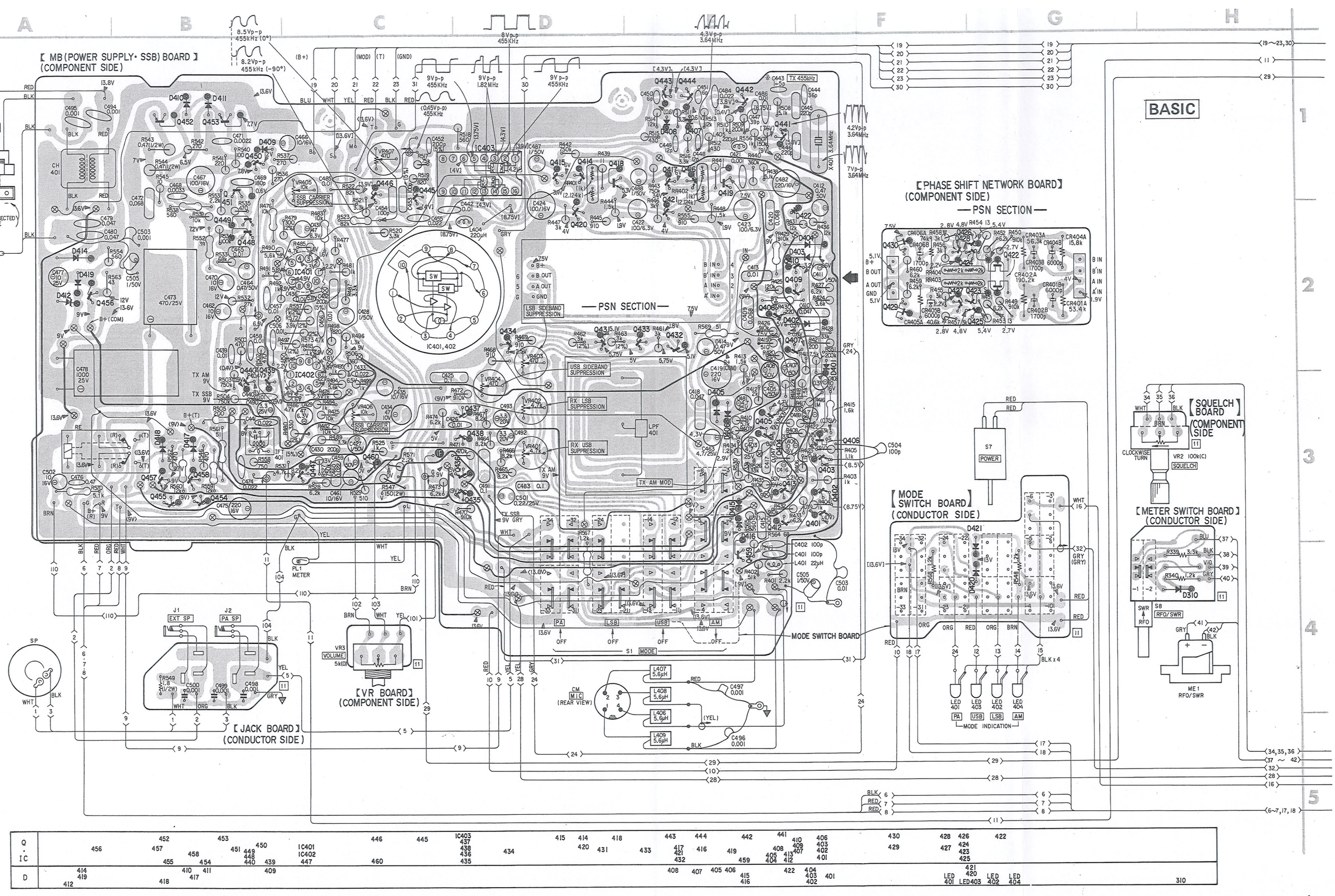
- : indicates side identified with part number
- Through hole
- Component side pattern
- component side B+ pattern
- : B+ pattern

Abbreviation

ALC..... Automatic Level Control
BCD..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
Δ Tune .. Delta Tune



| | | |


【MB(POWER SUPPLY・SSB) BOARD】
(COMPONENT SIDE)
【PHASE SHIFT NETWORK BOARD】
(COMPONENT SIDE)
—PSN SECTION—
BASIC
【MODE SWITCH BOARD】
(CONDUCTOR SIDE)
【SQUELCH】 【BOARD】 (COMPONENT SIDE)
【METER SWITCH BOARD】
(CONDUCTOR SIDE)
【VR BOARD】
(COMPONENT SIDE)
【JACK BOARD】
(CONDUCTOR SIDE)
MODE SWITCH BOARD
MODE INDICATION
2P CONNECTOR
B+ INPUT DC 13.8V
(NOT CONNECTED TO FRAME)
IC401,402
IC403
LSB SIDEBAND SUPPRESSION
USB SIDEBAND SUPPRESSION
RX LSB SUPPRESSION
RX USB SUPPRESSION
SSB CARRIER SUPPRESSION
TX AM MOD
LPF 401
PL1 METER
VR3 VOLUME 5kΩ
S1 (MODE)
S7 POWER
VR2 100kΩ(C)
SQUELCH
S8 RFO/SWR
ME1 RFO/SWR
CM MIC (REAR VIEW)
SP
J1 EXT SP
J2 PA SP
LED 401 PA
LED 403 USB
LED 402 LSB
LED 404 AM
D310
D420
D421

| | | |

4-2. MOUNTING DIAGRAM – Synthesizer and Frequency Converter Section; basic –

Replacement Semiconductors

For replacement, use semiconductors except in ( ).

Q101, 311: 2SC1583

Q102: 2SC1963

Q103 – 105, 109, 110
Q201, 203 – 207,
Q303, 305
Q604, 606, 618 – 620
Q622, 623
: 2SC710

Q106: 2SC1209

Q107, 603 : 2SK23A-824 (2SK23A)
Q605, 617
Q613: 2SK23A-860 (2SK23A)

Q108: 2SC1129

Q202, 211, 212
Q602, 607, 609 – 612
Q614 – 616, 624
: 2SC634A (2SC1363) IC201: μPD861C

Q208, 309: 2SC1474

Q209: 2SA678
Q608, 621: 2SA678 (2SA677)

Q301, 302, 601: 3SK37

Q304: 2SK58

Q306: 2SC1124

Q307, 308, 312: 2SC1816

Q310: 2SC1061

D101 – 105, 202 – 221
D304 – 308, 313
D601 – 609
D106: FC543
D201: FC52C (FC52M)
D302, 303, 309: 10E2 (10E1)
: 1S1555

D301: SV02

D312: EQB01-09

IC202: MSM561

IC203: μA78L05AV

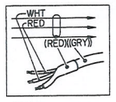
IC601: CX075B (CX075)

LED201: SL1272

LED301: TLR109

Note:

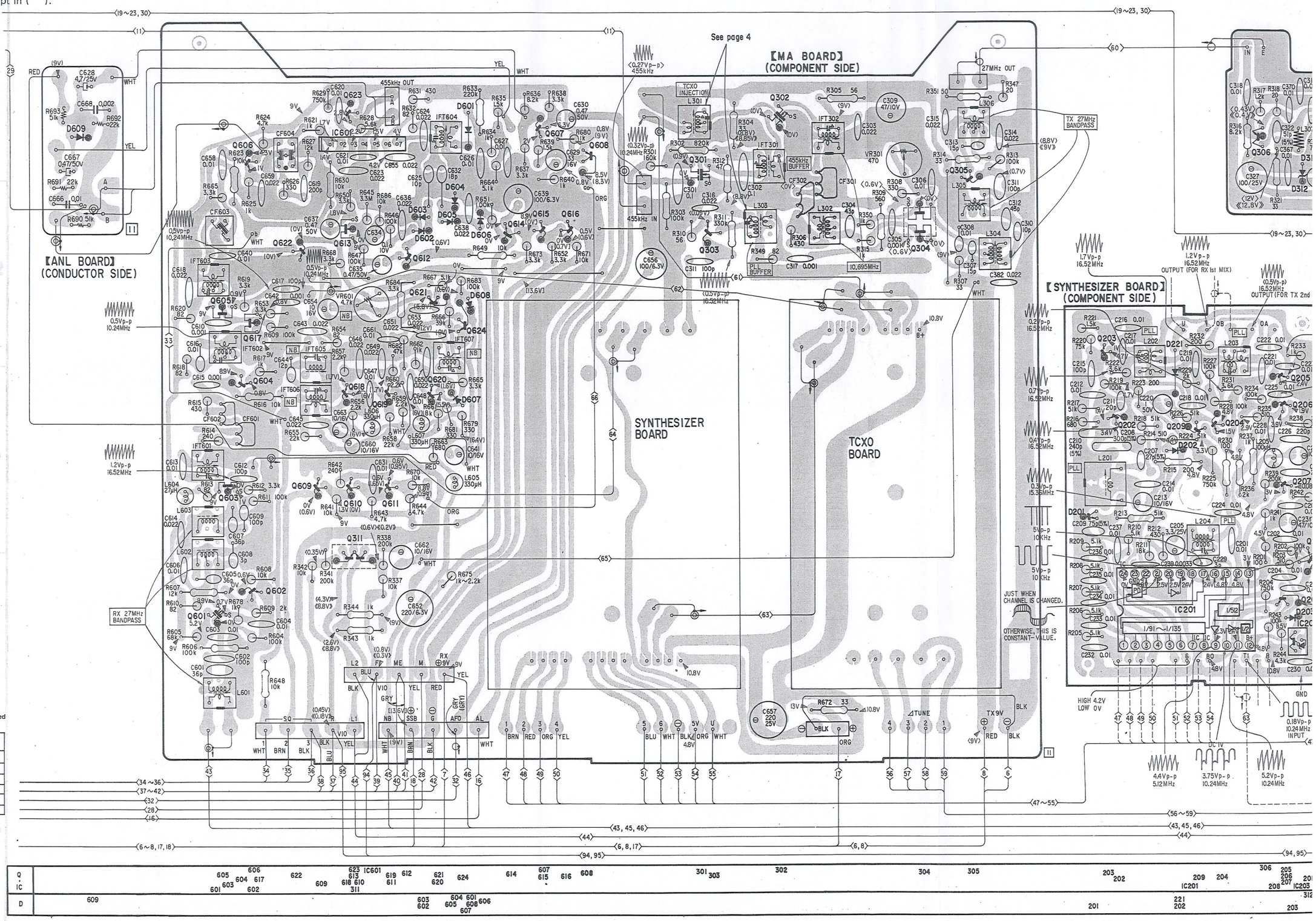
- Color code of sleeving over the end of the jacket.



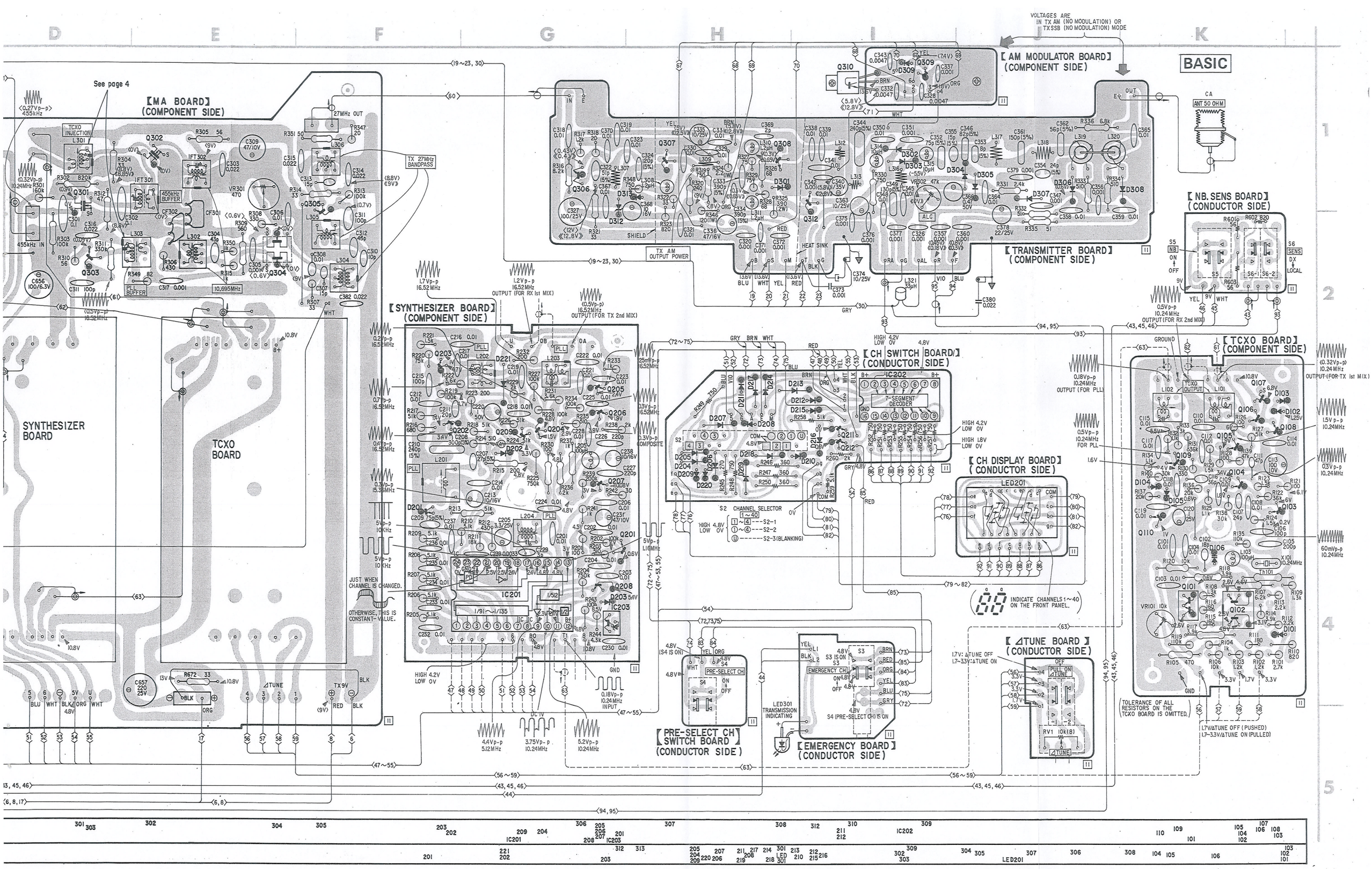
- : indicates side identified with part number.
- : B+ pattern
- Frequency of signal in the synthesizer board is deviated by selecting the channel as shown below.

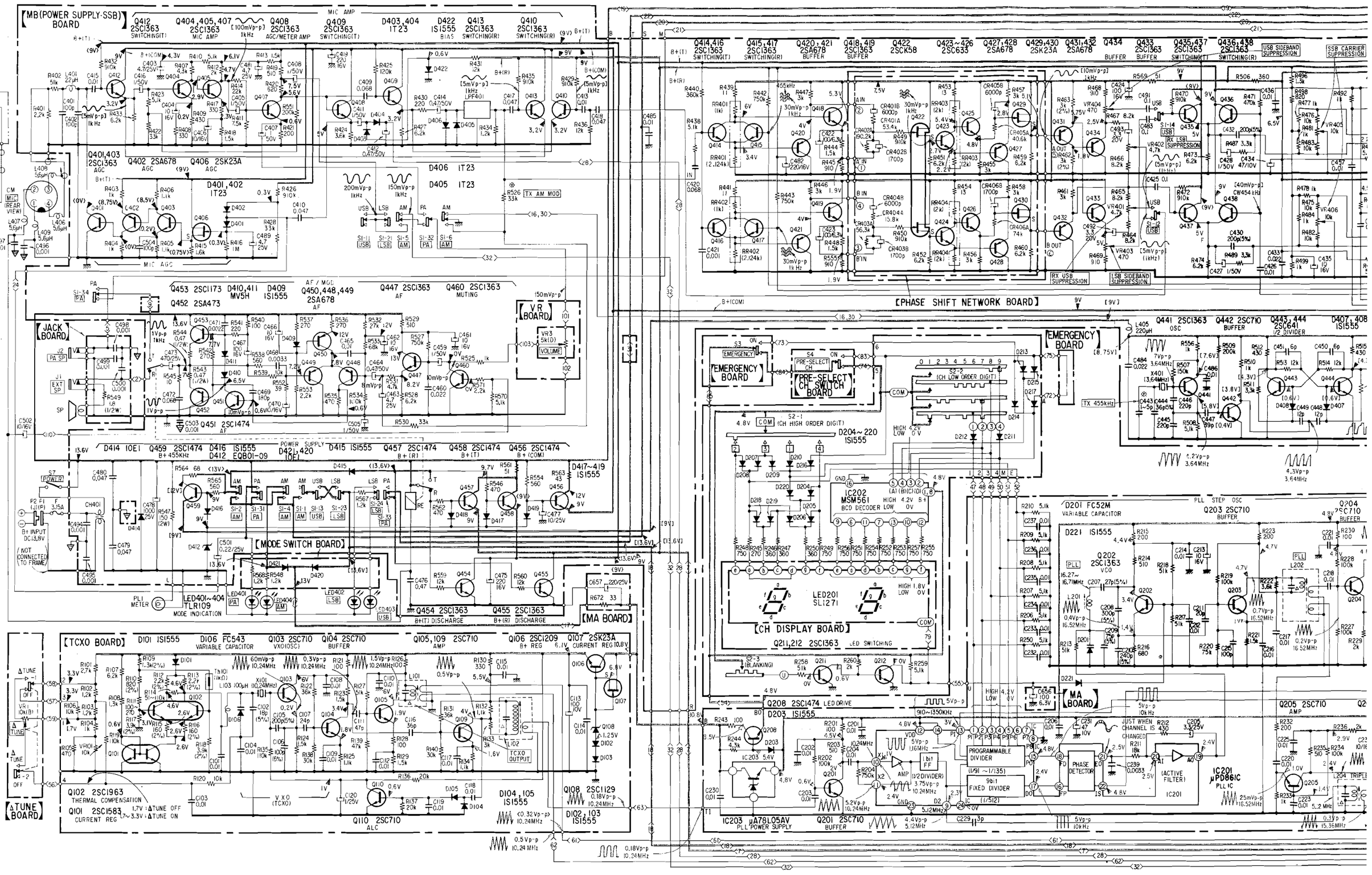
FREQUENCY	FREQUENCY DEVIATION (CH1 ~ CH40)
16.52 MHz	16.27 ~ 16.71 MHz
15.36 MHz	no deviation
10.24 MHz	no deviation
5.12 MHz	no deviation
1.16 MHz	0.91 ~ 1.35 MHz
10 kHz	no deviation

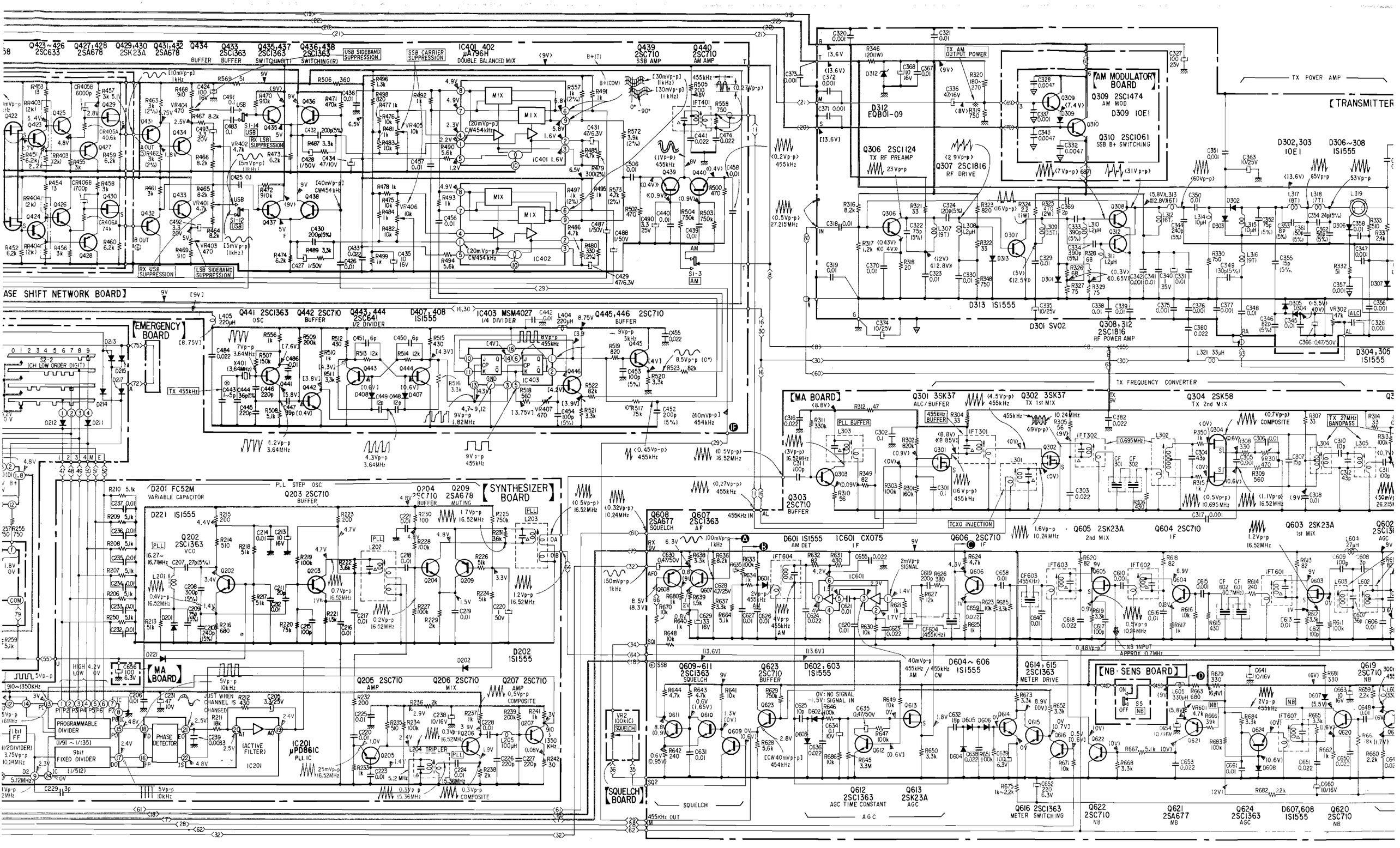
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, S5 (NB) is on and VR2 (SQUELCH) is at maximum position.
  [ ]: TX AM
  < >: TX SSB



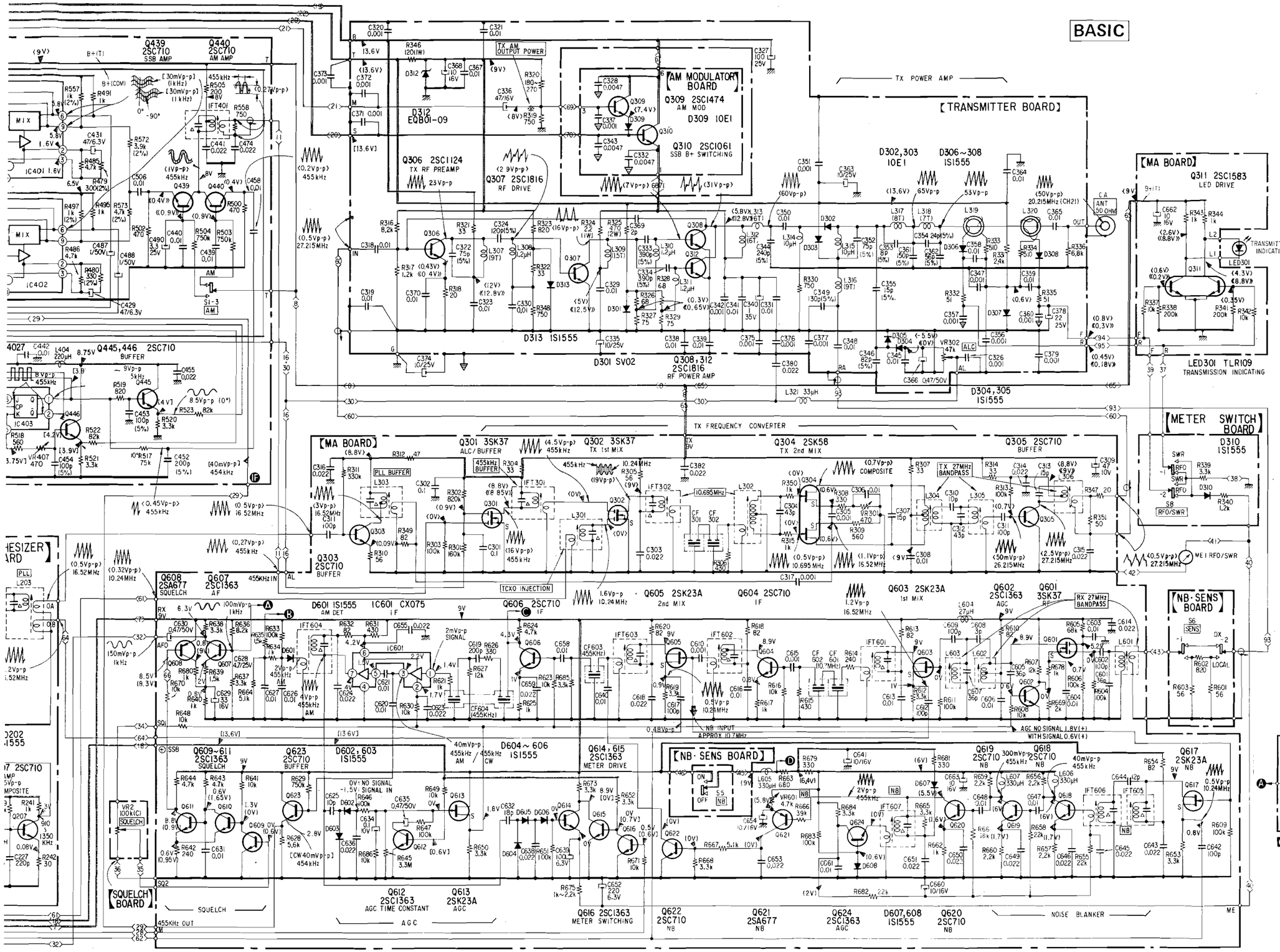
Q · IC	601	603	605	606	604	617	602	622	609	623	IC601	613	618	610	311	619	611	612	621	620	624	614	607	615	616	608	301	303	302	304	305	203	202	209	204	306	205	206	207	IC203
D	609																		603	602	604	605	601	606	607								201		221	202						203	


BASIC
【MA BOARD】 (COMPONENT SIDE)
【AM MODULATOR BOARD】 (COMPONENT SIDE)
【TRANSMITTER BOARD】 (COMPONENT SIDE)
【NB. SENS BOARD】 (CONDUCTOR SIDE)
【SYNTHESIZER BOARD】 (COMPONENT SIDE)
【TCXO BOARD】 (COMPONENT SIDE)
【CH SWITCH BOARD】 (CONDUCTOR SIDE)
【CH DISPLAY BOARD】 (CONDUCTOR SIDE)
【⊿TUNE BOARD】 (CONDUCTOR SIDE)
【PRE-SELECT CH SWITCH BOARD】 (CONDUCTOR SIDE)
【EMERGENCY BOARD】 (CONDUCTOR SIDE)
SYNTHESIZER BOARD
TCXO BOARD
VOLTAGES ARE IN TX AM (NO MODULATION) OR TX SSB (NO MODULATION) MODE
See page 4
TX 27MHz BANDPASS
TX AM OUTPUT POWER
HEAT SINK
ANT 50 OHM
S5 NB ON OFF
S6 SENS DX LOCAL
OUTPUT (FOR RX 1st MIX)
OUTPUT (FOR TX 2nd MIX)
OUTPUT (FOR RX 2nd MIX)
OUTPUT (FOR TX 1st MIX)
OUTPUT (FOR PLL)
JUST WHEN CHANNEL IS CHANGED.
OTHERWISE, THIS IS CONSTANT-VALUE.
S2 CHANNEL SELECTOR
S2-1
S2-2
S2-3 (BLANKING)
INDICATE CHANNELS 1~40 ON THE FRONT PANEL.
LED301 TRANSMISSION INDICATING
S4 (PRE-SELECT CH) IS ON
1.7V: ⊿TUNE OFF
1.7~3.3V: ⊿TUNE ON
1.7V/⊿TUNE OFF (PUSHED)
1.7~3.3V/⊿TUNE ON (PULLED)
TOLERANCE OF ALL RESISTORS ON THE TCXO BOARD IS OMITTED.
IC201
IC202
IC203
LED201
7-SEGMENT DECODER
PULL ON ⊿TUNE
RV1 10k(B)
⊿TUNE


[MB (POWER SUPPLY-SSB) BOARD]
MIC AMP
Q412 2SC1363 SWITCHING(T)
Q404,405,407 2SC1363 MIC AMP
Q408 2SC1363 AGC/METER AMP
Q409 2SC1363 SWITCHING(T)
D403,404 1T23
D422 1S1555 BIAS
Q413 2SC1363 SWITCHING(R)
Q410 2SC1363 SWITCHING(R)
Q401,403 2SC1363 AGC
Q402 2SA678 AGC
Q406 2SK23A AGC
D401,402 1T23
D406 1T23
D405 1T23
MIC AGC
MIC F EQ
CM MIC (REAR VIEW)
PA
AF / MOD
Q453 2SC1173 D410,411 MV5H D409 Q450,448,449 2SA678 AF
Q452 2SA473
Q447 2SC1363 AF
Q460 2SC1363 MUTING
JACK BOARD
J2 PA SP
J1 EXT SP
SP
VR BOARD
VR3 5k(D) VOLUME
POWER SUPPLY
D414 10E1 B+ 455KHz
Q459 2SC1474
D416 1S1555
D412 EQB01-09
D421,420 10E1
D415 1S1555
Q457 2SC1474 B+(R)
Q458 2SC1474 B+(T)
Q456 2SC1474 B+(COM)
D417~419 1S1555
S7 POWER
B+ INPUT DC13.8V
NOT CONNECTED TO FRAME
[MODE SWITCH BOARD]
PLL METER
LED401~404 TLR109 MODE INDICATION
Q454 2SC1363 B+(T) DISCHARGE
Q455 2SC1363 B+(R) DISCHARGE
[MA BOARD]
TX AM MOD
Q414,416 2SC1363 SWITCHING(T)
Q415,417 2SC1363 SWITCHING(R)
Q420,421 2SA678 BUFFER
Q418,419 2SC1363 BUFFER
Q422 2SK58
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678 BUFFER
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
USB SIDEBAND SUPPRESSION
SSB CARRIER SUPPRESSION
RX LSB SUPPRESSION
RX USB SUPPRESSION
LSB SIDEBAND SUPPRESSION
[PHASE SHIFT NETWORK BOARD]
[EMERGENCY BOARD]
[PRE-SELECT CH SWITCH BOARD]
S2-2 (CH LOW ORDER DIGIT)
S2-1 (CH HIGH ORDER DIGIT)
D204~220 1S1555
IC202 MSM561 BCD DECODER
[CH DISPLAY BOARD]
LED201 SL1271
Q211,212 2SC1363 LED SWITCHING
[TCXO BOARD]
D101 1S1555 VARIABLE CAPACITOR
D106 FC543
Q103 2SC710 VXO(OSC)
Q104 2SC710 BUFFER
Q105,109 2SC710 AMP
Q106 2SC1209 B+ REG
Q107 2SK23A CURRENT REG
Q102 2SC1963 THERMAL COMPENSATION
Q101 2SC1583 CURRENT REG
Q110 2SC710 ALC
Q108 2SC1129
D102,103 1S1555
D104,105 1S1555
TCXO OUTPUT
[ΔTUNE BOARD]
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407,408 1S1555
D201 FC52M VARIABLE CAPACITOR
D221 1S1555
Q202 2SC1363 VCO
Q203 2SC710 BUFFER
Q204 2SC710 BUFFER
Q205 2SC710 AMP
Q208 2SC1474 LED DRIVE
D203 1S1555
IC203 μA78L05AV PLL POWER SUPPLY
Q201 2SC710 BUFFER
IC201 μPD861C PLL IC
PROGRAMMABLE DIVIDER
PHASE DETECTOR
FIXED DIVIDER
(ACTIVE FILTER)
PLL STEP OSC


Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
USB SIDEBAND SUPPRESSION
SSB CARRIER SUPPRESSION
IC401 402 µA796H DOUBLE BALANCED MIX
Q439 2SC710 SSB AMP
Q440 2SC710 AM AMP
RX USB SUPPRESSION
LSB SIDEBAND SUPPRESSION
RX LSB SUPPRESSION
IC402
IC401 1.6V
AM
ASE SHIFT NETWORK BOARD
EMERGENCY BOARD
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407,408 1S1555
IC403 MSM4027 1/4 DIVIDER
Q445,446 2SC710 BUFFER
X401 (3.64MHz)
TX 455kHz
PLL STEP OSC
D201 FC52M VARIABLE CAPACITOR
Q203 2SC710 BUFFER
Q204 Q209 2SA678 MUTING
SYNTHESIZER BOARD
Q202 2SC1363 VCO
D221 1S1555
D202 1S1555
MA BOARD
Q205 2SC710 AMP
Q206 2SC710 MIX
Q207 2SC710 AMP
IC201 µPD861C PLL IC
PROGRAMMABLE DIVIDER
9bit FIXED DIVIDER
PHASE DETECTOR
(ACTIVE FILTER)
L204 TRIPLER
D308 1S1555
Q308,312 2SC1816 RF POWER AMP
D301 SV02
D313 1S1555
Q306 2SC1124 TX RF PREAMP
Q307 2SC1816 RF DRIVE
Q310 2SC1061 SSB B+ SWITCHING
D312 EQB01-09
AM MODULATOR BOARD
Q309 2SC1474 AM MOD
D309 10E1
TX AM OUTPUT POWER
TX POWER AMP
TRANSMITTER
D302,303 10E1
D306~308 1S1555
D304,305 1S1555
TX FREQUENCY CONVERTER
MA BOARD
Q301 3SK37 ALC/BUFFER
Q302 3SK37 TX 1st MIX
Q304 2SK58 TX 2nd MIX
Q303 2SC710 BUFFER
PLL BUFFER
TCXO INJECTION
Q608 2SA677 SQUELCH
Q607 2SC1363 AF
D601 1S1555 AM DET
IC601 CX075 IF
Q606 2SC710 IF
Q605 2SK23A 2nd MIX
Q604 2SC710 IF
Q603 2SK23A 1st MIX
Q602 2SC1363 AGC
Q609~611 2SC1363 SQUELCH
Q623 2SC710 BUFFER
D602,603 1S1555
D604~606 1S1555
Q614,615 2SC1363 METER DRIVE
NB·SENS BOARD
SQUELCH BOARD
Q612 2SC1363 AGC TIME CONSTANT
Q613 2SK23A AGC
Q616 2SC1363 METER SWITCHING
Q622 2SC710 NB
Q621 2SA677 NB
Q624 2SC1363 AGC
D607,608 1S1555
Q620 2SC710 NB
AGC

BASIC



Note:

- All capacitors are in μF unless otherwise noted. pF = μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000Ω, MΩ = 1000kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2 % indicates component tolerance.
- △ : internal component.
- * : selected to yield optimum performance.
- ▬ : B+ bus.
- ▭ : panel designation.
- ▭ : adjustment for repair.
- ⏚ : direct connection to chassis.
- ▨ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	OX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  Approx. 230 mA (RX AM)
  Approx. 230 mA (RX SSB)
  1.8 A ..... antenna load 5Ω
  (TX AM, NO MODULATION)
  2.6 A ..... no antenna load
  (TX AM, NO MODULATION)
  780 mA (TX SSB, NO MODULATION)
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, SS (NB) is on and VR2 (SQUELCH) is at maximum position.
  [ ]: TX AM
  ≪ ≫: TX SSB
- Relation between signal frequency and sweep time/cm of oscilloscope.

SIGNAL FREQUENCY	SWEEP TIME/CM
1 kHz	1 mSEC
10 kHz	0.1 mSEC
455 kHz	2.1 μSEC
1.16 MHz	0.62 μSEC (620 nSEC)
1.82 MHz	0.62 μSEC (620 nSEC)
3.64 MHz	0.27 μSEC (270 nSEC)
5.12 MHz	0.19 μSEC (190 nSEC)
10.24 MHz	97 nSEC
15.36 MHz	65 nSEC
16.52 MHz	60 nSEC
27.215 MHz	38 nSEC

- Signal waveforms are in RX AM (S6: DX) mode, when signal ..... 27.215 MHz 40 dB (1 kHz, 30% modulation) ..... is supplied at antenna, unless otherwise noted on the below table. The waveforms are indicated to show the circuit basically.

SECTION	MODE	CHANNEL	SIGNAL APPLIED	SIGNAL OBTAINED
TX FREQUENCY CONVERTER and TX POWER AMP	TX AM	21	——	——
RF AMP	RX AM	21	27.215 MHz 40 dB (1 kHz, 30% modulation) at antenna	——
AM DET	RX LSB	21	27.215 MHz 40 dB (continuous wave) at antenna	1 kHz beat at speaker terminals
SSB demodulator and MIC AMP	RX LSB	——	454 kHz 40 mVp-p (continuous wave) at terminal (F) in MB board	——
AF AMP	RX AM	21	27.215 MHz 40 dB (1 kHz, 30% modulation) at antenna	1 Vp-p at speaker terminals
455 kHz OSC	RX LSB	——	——	——
VXO and PLL (Except for secondary waveforms of L101, L102 and L203)	RX AM	——	——	——

- For the details, see the schematic diagram in each mode (RX AM, RX SSB, TX AM or TX SSB).

- **Abbreviation**

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO ..... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
Δ Tune .. Delta Tune

ICB-2500

Note.

- All capacitors are in μF unless otherwise noted. pF: μμF. 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms. 1/4W (5%) unless otherwise noted. k: 1000Ω, M: 1000kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏦ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

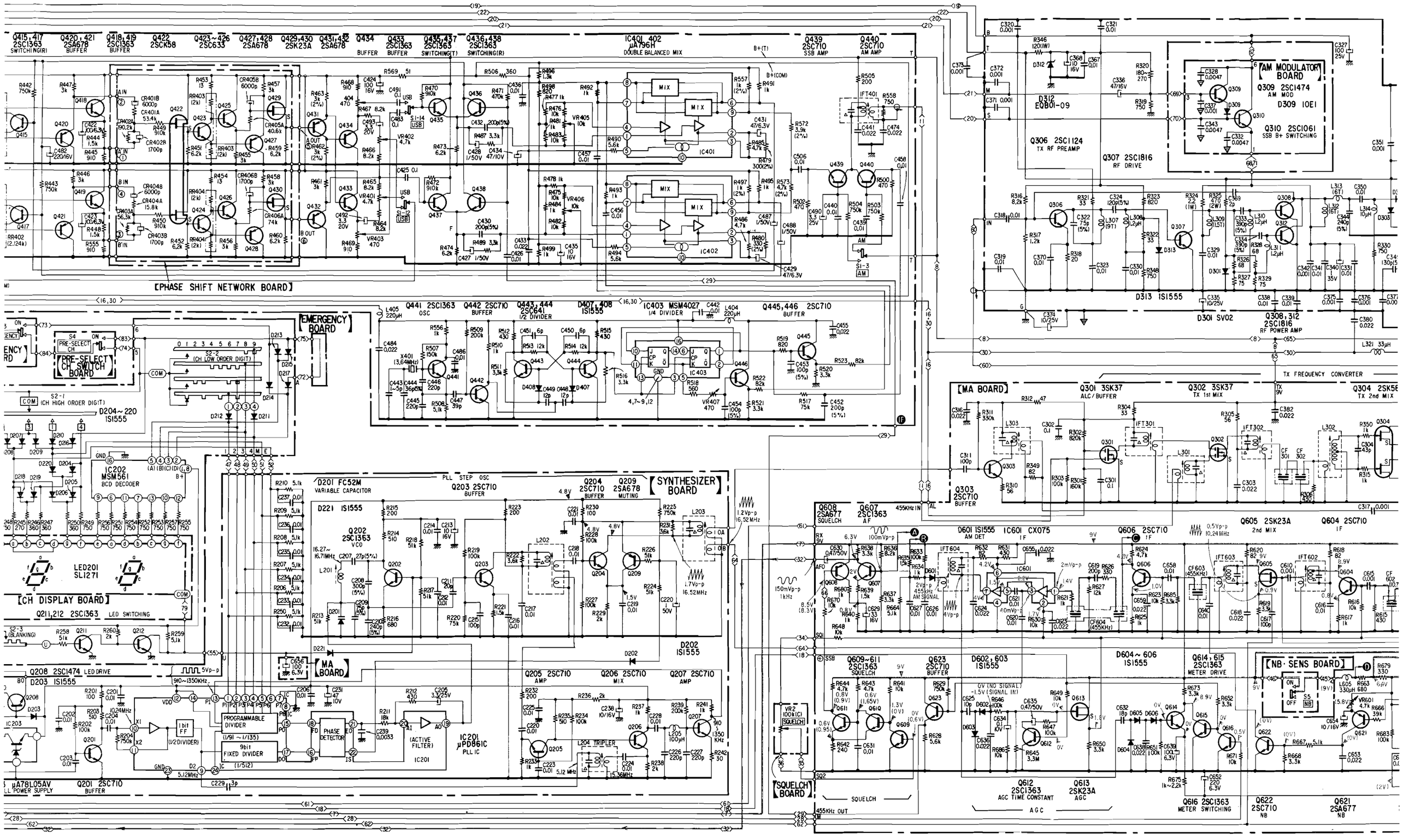
Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

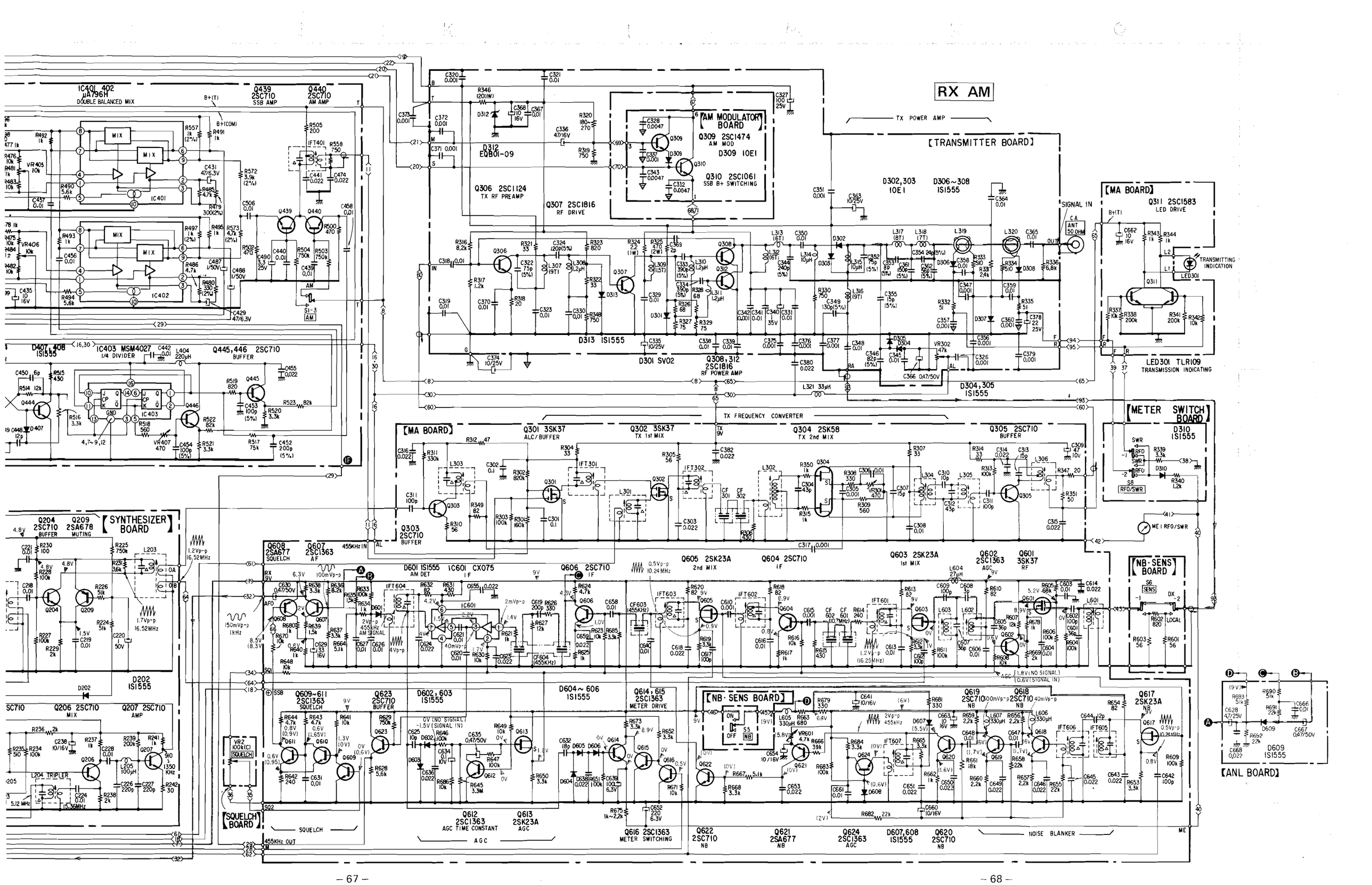
- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain: Approx. 230 mA
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, S5 (NB) is on and VR2 (SQUELCH) is at maximum position.
- Signal waveforms are taken under condition as follows.
  Mode: RX AM, S6 (SENS) is DX
  Channel: 21
  Signal applied: 27.215 MHz 40 dB (1 kHz, 30% modulation) at antenna
  Signal obtained: 1 Vp-p at speaker terminals by adjusting VR3 (VOLUME)
- Signal waveforms in 455 kHz OSC, PLL and VXO sections are indicated in basic schematic diagram.

- **Abbreviation**

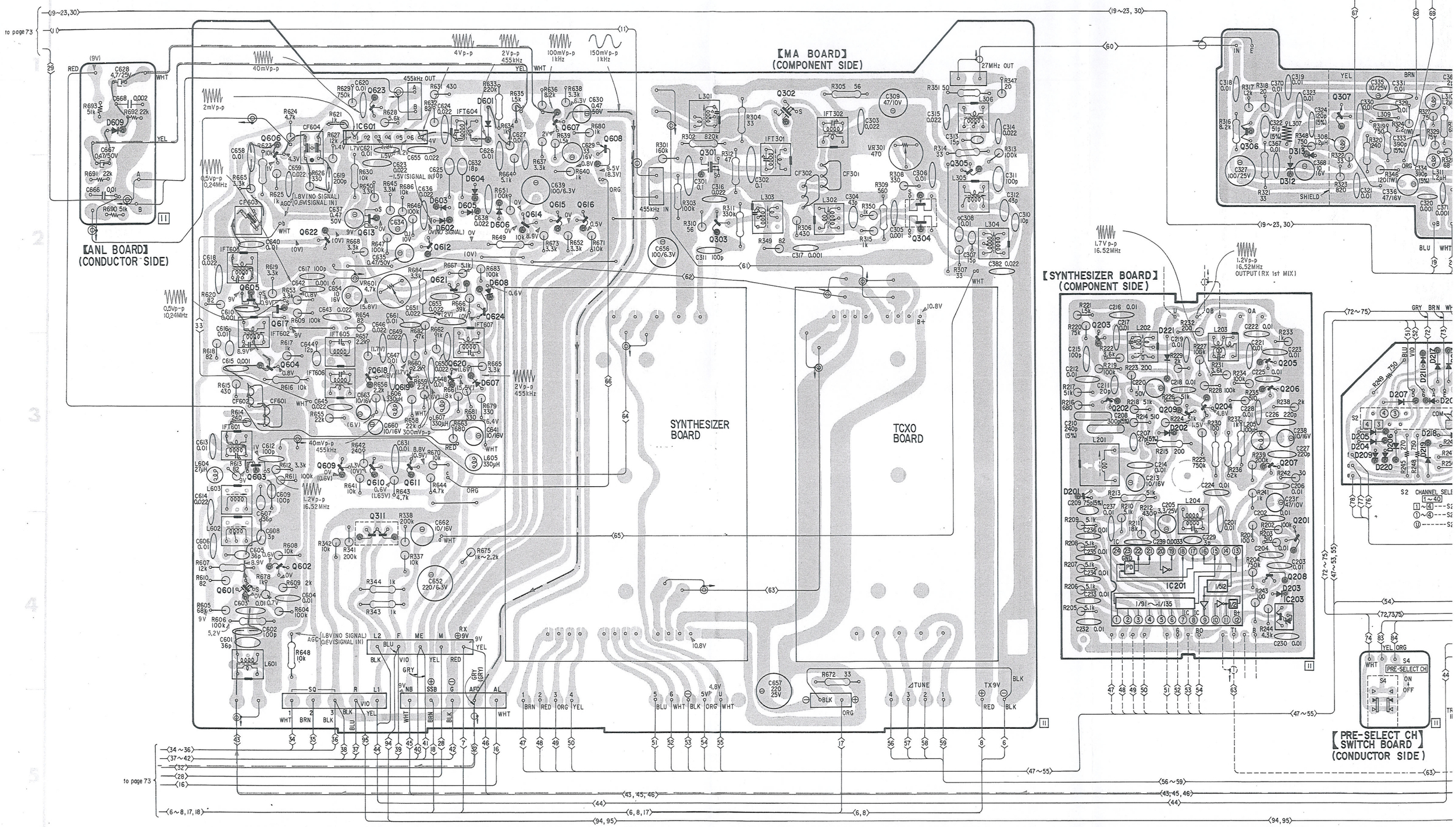
ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX ... Receiving
T or TX ... Transmitting
TCXO ..... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
△ Tune ... Delta Tune

ICB-2500

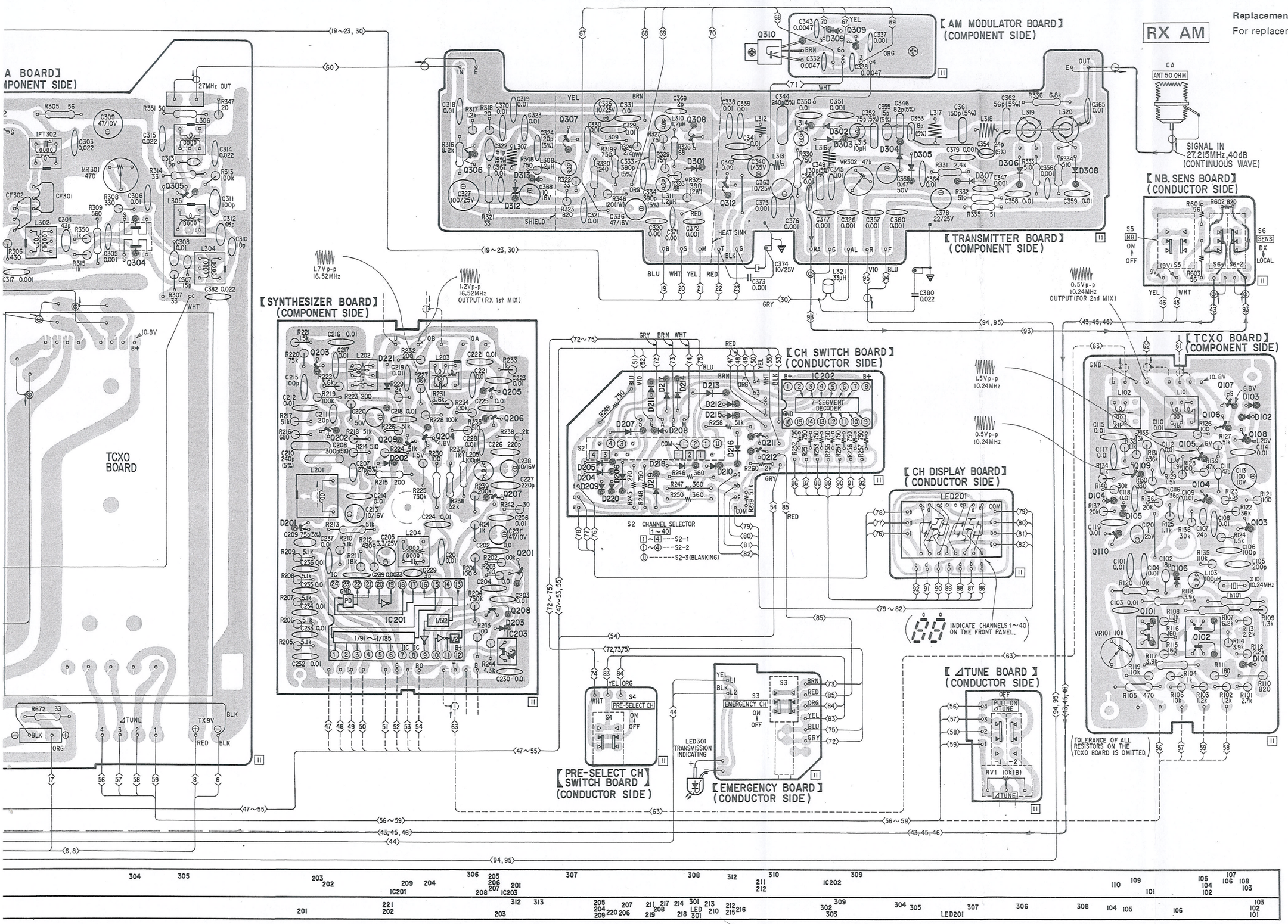

Q415,417 2SC1363 SWITCHING(R)
Q420,421 2SA678 BUFFER
Q418,419 2SC1363 BUFFER
Q422 2SCK58
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
IC401,402 μA796H DOUBLE BALANCED MIX
Q439 2SC710 SSB AMP
Q440 2SC710 AM AMP
[PHASE SHIFT NETWORK BOARD]
[PRE-SELECT CH SWITCH BOARD]
[EMERGENCY BOARD]
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407,408 1S1555
IC403 MSM4027 1/4 DIVIDER
Q445,446 2SC710 BUFFER
[AM MODULATOR BOARD]
Q309 2SC1474 AM MOD
D309 10E1
Q310 2SC1061 SSB B+ SWITCHING
D312 E0B01-09
Q306 2SC1124 TX RF PREAMP
Q307 2SC1816 RF DRIVE
D313 1S1555
D301 SV02
Q308,312 2SC1816 RF POWER AMP
TX FREQUENCY CONVERTER
[MA BOARD]
Q301 3SK37 ALC/BUFFER
Q302 3SK37 TX 1st MIX
Q304 2SK58 TX 2nd MIX
Q303 2SC710 BUFFER
IC202 MSM561 BCD DECODER
LED201 SL1271
[CH DISPLAY BOARD]
Q211,212 2SC1363 LED SWITCHING
Q208 2SC1474 LED DRIVE
D203 1S1555
μA78L05AV POWER SUPPLY
Q201 2SC710 BUFFER
D201 FC52M VARIABLE CAPACITOR
PLL STEP OSC
Q203 2SC710 BUFFER
Q204 2SC710 BUFFER
Q209 2SA678 MUTING
[SYNTHESIZER BOARD]
Q202 2SC1363 VCO
D221 1S1555
D202 1S1555
Q205 2SC710 AMP
Q206 2SC710 MIX
Q207 2SC710 AMP
IC201 μPD861C PLL IC
PROGRAMMABLE DIVIDER
9bit FIXED DIVIDER
PHASE DETECTOR
[MA BOARD]
Q608 2SA677 SQUELCH
Q607 2SC1363 AF
D601 1S1555 AM DET
IC601 CX075 IF
Q606 2SC710 IF
Q605 2SK23A 2nd MIX
Q604 2SC710 IF
Q609~611 2SC1363 SQUELCH
Q623 2SC710 BUFFER
D602,603 1S1555
D604~606 1S1555
Q614,615 2SC1363 METER DRIVE
[NB·SENS BOARD]
[SQUELCH BOARD]
Q612 2SC1363 AGC TIME CONSTANT
Q613 2SK23A AGC
Q616 2SC1363 METER SWITCHING
Q622 2SC710 NB
Q621 2SA677 NB


RX AM
[TRANSMITTER BOARD]
[AM MODULATOR BOARD]
Q309 2SC1474
AM MOD
D309 10E1
Q310 2SC1061
SSB B+ SWITCHING
Q306 2SC1124
TX RF PREAMP
Q307 2SC1816
RF DRIVE
D312
EQ801-09
TX POWER AMP
D302,303
10E1
D306~308
1S1555
Q308,312
2SC1816
RF POWER AMP
D301 SV02
D313 1S1555
D304,305
1S1555
SIGNAL IN
ANT
50 OHM
[MA BOARD]
Q311 2SC1583
LED DRIVE
TRANSMITTING INDICATION
LED301
LED301 TLR109
TRANSMISSION INDICATING
[METER SWITCH BOARD]
D310
1S1555
TX FREQUENCY CONVERTER
Q301 3SK37
ALC/BUFFER
Q302 3SK37
TX 1st MIX
Q304 2SK58
TX 2nd MIX
Q305 2SC710
BUFFER
Q303
2SC710
BUFFER
IC401 402
μA796H
DOUBLE BALANCED MIX
Q439
2SC710
SSB AMP
Q440
2SC710
AM AMP
IC403 MSM4027
1/4 DIVIDER
Q445,446 2SC710
BUFFER
D407,408
1S1555
[SYNTHESIZER BOARD]
Q204
BUFFER
Q209
2SA678
MUTING
D202
1S1555
Q206 2SC710
MIX
Q207 2SC710
AMP
L204 TRIPLER
[SQUELCH BOARD]
SQUELCH
Q608
2SA677
SQUELCH
Q607
2SC1363
AF
D601 1S1555
AM DET
IC601 CX075
IF
Q606 2SC710
IF
Q605 2SK23A
2nd MIX
Q604 2SC710
IF
Q603 2SK23A
1st MIX
Q602
2SC1363
AGC
Q601
3SK37
RF
[NB·SENS BOARD]
D609
1S1555
[ANL BOARD]
Q609~611
2SC1363
SQUELCH
Q623
2SC710
BUFFER
D602,603
1S1555
D604~606
1S1555
Q614,615
2SC1363
METER DRIVE
Q612
2SC1363
AGC TIME CONSTANT
Q613
2SK23A
AGC
Q616 2SC1363
METER SWITCHING
Q622
2SC710
NB
Q621
2SA677
NB
Q624
2SC1363
AGC
D607,608
1S1555
Q620
2SC710
NB
Q619
2SC710
NB
Q618
2SC710
NB
Q617
2SK23A
NB
NOISE BLANKER
455KHz IN
455KHz OUT
SQUELCH
AGC
NB

4-5. MOUNTING DIAGRAM – Synthesizer and Frequency Converter Section; RX AM –



Q, IC	601 603 604 605 606 602 617 622 609 623 613 618 610 311 IC601 619 611 612 621 620 624 614 607 615 616 608 301 303 302 304 305 203 202 209 204 IC201 306 205 206 207 208 201 IC203 307
D	609 603 602 604 605 601 608 606 607 201 221 202 203 312 313 205 204 209 207 220 206 211 217 208 219



Replacement Semiconductors

For replacement, use semiconductors except in ( ).

Q101, 311: 2SC1583

Q102: 2SC1963

Q103 – 105, 109, 110
Q201, 203 – 207,
Q303, 305
Q604, 606, 618 – 620
Q622, 623
: 2SC710

Q106: 2SC1209

Q107, 603
Q605, 617
: 2SK23A-824 (2SK23A)

Q613: 2SK23A-860 (2SK23A)

Q108: 2SC1129

Q202, 211, 212
Q602, 607, 609 – 612
Q614 – 616, 624
: 2SC634A (2SC1363) IC201: μPD861C

Q208, 309: 2SC1474

Q209: 2SA678
Q608, 621: 2SA678 (2SA677)

Q301, 302, 601: 3SK37

Q304: 2SK58

Q306: 2SC1124

Q307, 308, 312: 2SC1816

Q310: 2SC1061

D101 – 105, 202 – 221
D304 – 308, 313
D601 – 609
D106: FCS43
D201: FCS2C (FCS2M)
D302, 303, 309: 10E2 (10E1)
: 1S1555

D301: SV02

D312: EQB01-09

IC202: MSM561

IC203: μA78L05AV

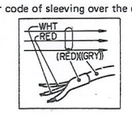
IC601: CX075B (CX075)

LED201: SL1272

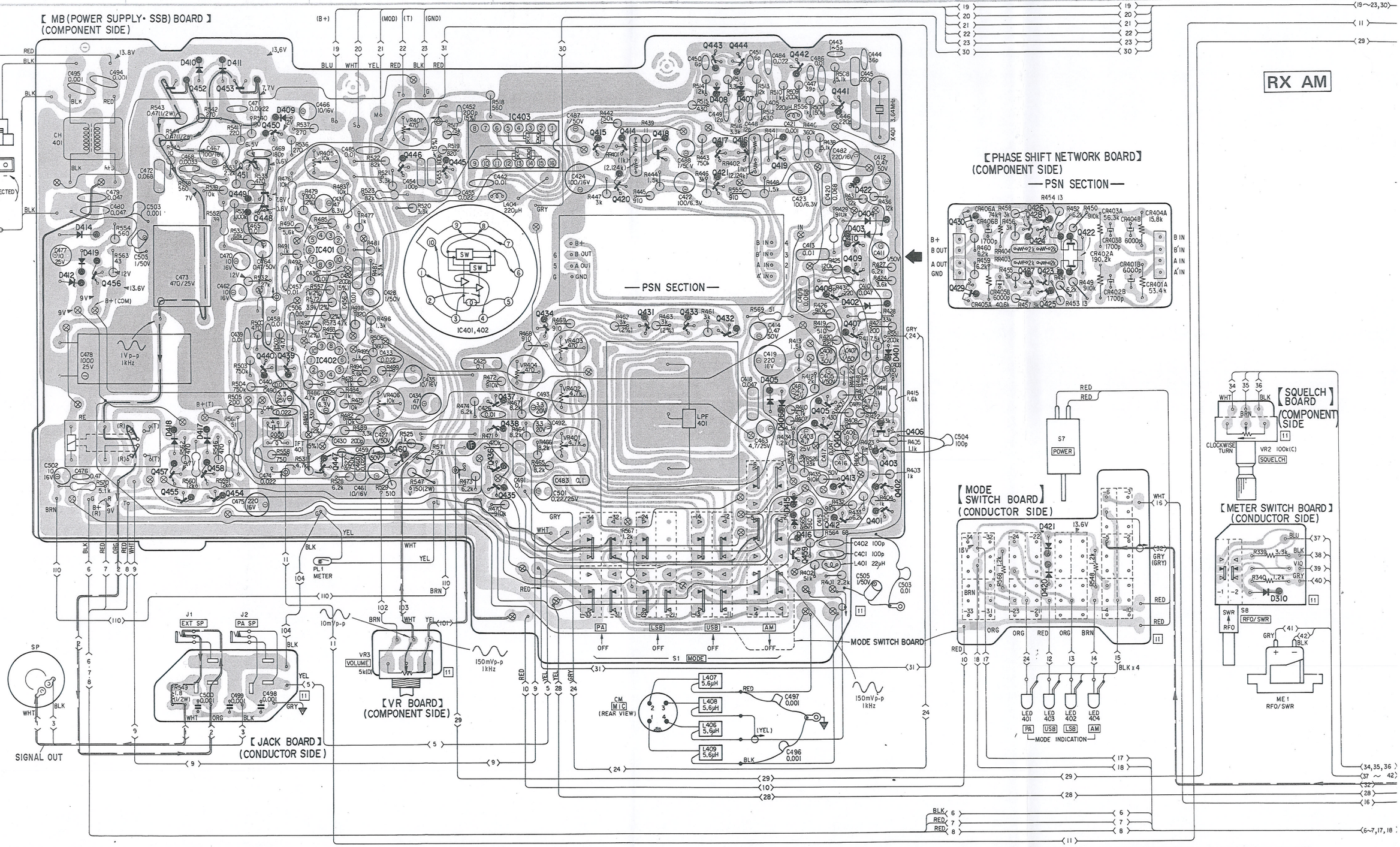
LED301: TLR109

Note:

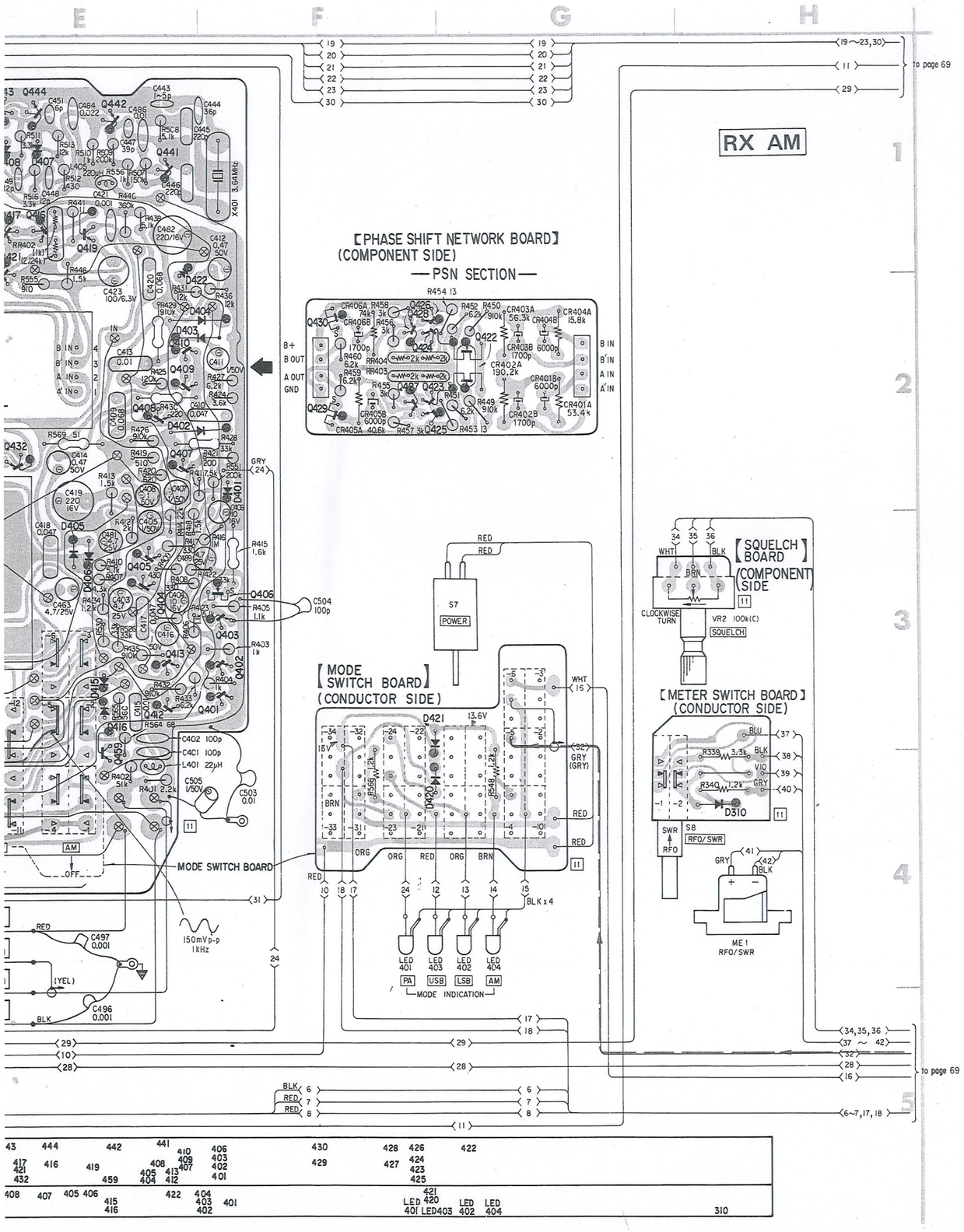
- Color code of sleeving over the end of the jacket.



- : indicates side identified with part number.
- : B+ pattern
- : signal path
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, S5 (NB) is on and VR2 (SQUELCH) is at maximum position.


【MB(POWER SUPPLY・SSB)BOARD】
(COMPONENT SIDE)
(B+) (MOD) (T) (GND)
19 20 21 22 23 31
BLU WHT YEL RED BLK RED
30
13.8V
13.6V
F 3.15A
2P CONNECTOR
B+ INPUT DC 13.8V
(NOT CONNECTED TO FRAME)
P1 (P)
CH 401
IC401,402
IC403
SW
— PSN SECTION —
LPF 401
IF1 401
PL1 METER
VR401 470
VR402 4.7k
VR403 470
VR404 470
VR405 10k
VR406 10k
VR407 470
S1 MODE
PA LSB USB AM
OFF
L404 220μH
X401 3.64MHz
CM MIC (REAR VIEW)
L407 5.6μH
L408 5.6μH
L406 5.6μH
L409 5.6μH
C497 0.001
C496 0.001
C504 100p
C505 1/50V
C503 0.01
C402 100p
C401 100p
L401 22μH
MODE SWITCH BOARD
150mVp-p 1kHz
10mVp-p
SP
J1 EXT SP
J2 PA SP
VR3 VOLUME 5k(D)
【VR BOARD】
(COMPONENT SIDE)
【JACK BOARD】
(CONDUCTOR SIDE)
SIGNAL OUT
【PHASE SHIFT NETWORK BOARD】
(COMPONENT SIDE)
— PSN SECTION —
B+ B OUT A OUT GND
B IN B'IN A IN A'IN
【MODE SWITCH BOARD】
(CONDUCTOR SIDE)
S7 POWER
LED 401 LED 403 LED 402 LED 404
PA USB LSB AM
MODE INDICATION
【METER SWITCH BOARD】
(CONDUCTOR SIDE)
【SQUELCH BOARD】
(COMPONENT SIDE)
CLOCKWISE TURN
VR2 100k(C)
SQUELCH
SWR RFO
S8 RFO/SWR
METER RFO/SWR
D310
RX AM
19~23,30
11
29

| | | |



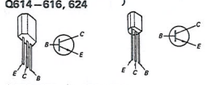
Replacement Semiconductors

For replacement, use semiconductors except in ( ).

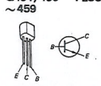
Q439, 440, 442, Q445, 446: 2SC710

Q406: 2SK23A-B24 (2SK23A)
Q429, 430: 2SK23A-B12 (2SK23A)

Q401, 403–405
Q407–410, 412–419
Q433, 435–438, 441
Q447, 454, 455, 460
Q602, 607, 609–612
Q614–616, 624
: 2SC634A (2SC1363)



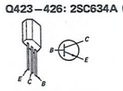
Q451, 456 ~458: 2SC1474



Q402, 420, 421, 427, Q428, 431, 432, 434, Q448–450: 2SA678

Q422: 2SK58

Q423–426: 2SC634A (2SC633)

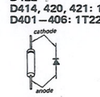


Q443, 444: 2SC641K (2SC641)

Q452: 2SA473

Q453: 2SC1173

D310
D407–409, 415–419, D422
D414, 420, 421: 10E2 (10E1)
D401–406: 1T22A (1T23)
: 1S1555



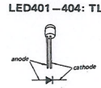
D412: EQB01-09

D410, 411: VD1120 (MV5H)

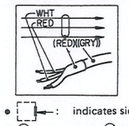
IC401, 402: μA796HC

IC403: MSM4027

LED401–404: TLR109



Note:
- Color code of sleeving over the end of the jacket.



- : indicates side identified with part number.
- Through hole
  Component side pattern
- component side B+ pattern
- : B+ pattern
- Signal Path
  ——→ : MAIN SIGNAL
  - - - → : 455 kHz
  —·—→ : 10.24 MHz
  —··—→ : 16.52 MHz

Note: (for schematic diagram)

- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000Ω, MΩ = 1000kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain: Approx. 230 mA
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  no mark: RX AM
  ( ): RX AM, S5 (NB) is on and VR2 (SQUELCH) is at maximum position.
- Signal waveforms are taken under condition as follows.
  Mode: RX AM, S6 (SENS) is DX
  Channel: 21
  Signal applied: 27.215 MHz 40 dB (1 kHz, 30% modulation) at antenna
  Signal obtained: 1 Vp-p at speaker terminals by adjusting VR3 (VOLUME)
- Signal waveforms in 455 kHz OSC, PLL and VXO sections are indicated in basic schematic diagram.

Abbreviation

ALC..... Automatic Level Control
BCD..... Binary Coded Decimal
NB..... Noise Blanker
PLL..... Phase-locked Loop
PSN..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO..... Variable Crystal Oscillator
Δ Tune .. Delta Tune

Note: (for schematic diagram)

- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000 Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal comp nent.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery
- Transistor base-emitter voltages are measured on the 2.5.V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	LSB,
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain: Approx. 230 mA
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  ( ): S5 (NB) is on
- Signal waveforms are taken under condition as follows.
  Mode: RX LSB or RX USB, S6 (SENS) is DX
  Channel: 21
  Signal applied: 27.215 MHz, 40 dB (continuous wave) at antenna
  Signal obtained: 1 kHz beat at speaker terminals
- AGC voltage readings are taken under no signal condition and when applying signal indicated above.
- When 1 kHz beat appears in LSB mode, 2nd IF is 454 kHz. When 1 kHz beat appears in USB mode, 2nd IF is 456 kHz.

● Abbreviation

ALC . . . . . Automatic Level Control
BCD . . . . . Binary Coded Decimal
NB . . . . . Noise Blanker
PLL . . . . . Phase-locked Loop
PSN . . . . . Phase Shift Network
R or RX . . Receiving
T or TX . . Transmitting
TCXO . . . . Thermal Compensated Crystal Oscillator
VXO . . . . . Variable Crystal Oscillator
△ Tune . . Delta Tune

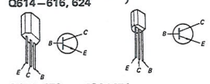
Replacement Semiconductors

For replacement, use semiconductors except in ( ).

Q439, 440, 442, Q445, 446: 2SC710

Q406: 2SK23A-824 (2SK23A)
Q429, 430: 2SK23A-812 (2SK23A)

Q401, 403–405
Q407–410, 412–419
Q433, 435–438, 441
Q447, 454, 455, 460
Q602, 607, 609–612
Q614–616, 624
: 2SC634A (2SC1363)



Q451, 456 ~459: 2SC1474

Q402, 420, 421, 427
Q428, 431, 432, 434
Q448–450
: 2SA678

Q422: 2SK58

Q423–426: 2SC634A (2SC633)

Q443, 444: 2SC641K (2SC641)

Q452: 2SA473

Q453: 2SC1173

D310
D407–409, 415–419
D422
D414, 420, 421: 10E2 (10E1)
D401–406: 1T22A (1T23)
: 1S1555

D412: EQB01-09

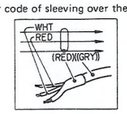
D410, 411: VD1120 (MV5H)

IC401, 402: μA796HC

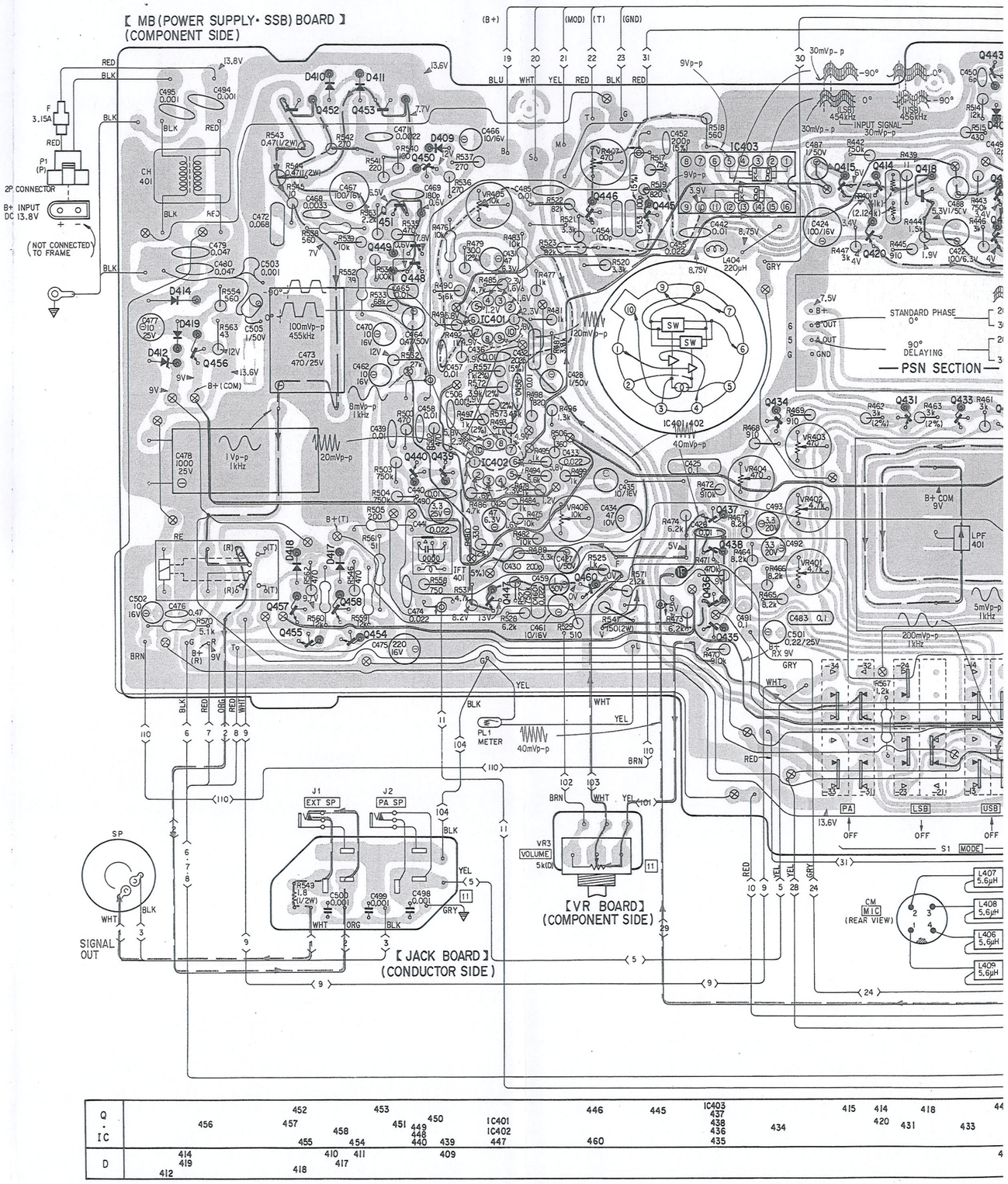
IC403: MSM4027

LED401–404: TLR109

Note:
- Color code of sleeving over the end of the jacket.



- ▭ : indicates side identified with part number.
- ⊗ Through hole
  Component side pattern
- ⊗ component side B+ pattern
- ▬ : B+ pattern
- Signal Path
  – – →: SIGNAL
  ----→: 455 kHz CARRIER



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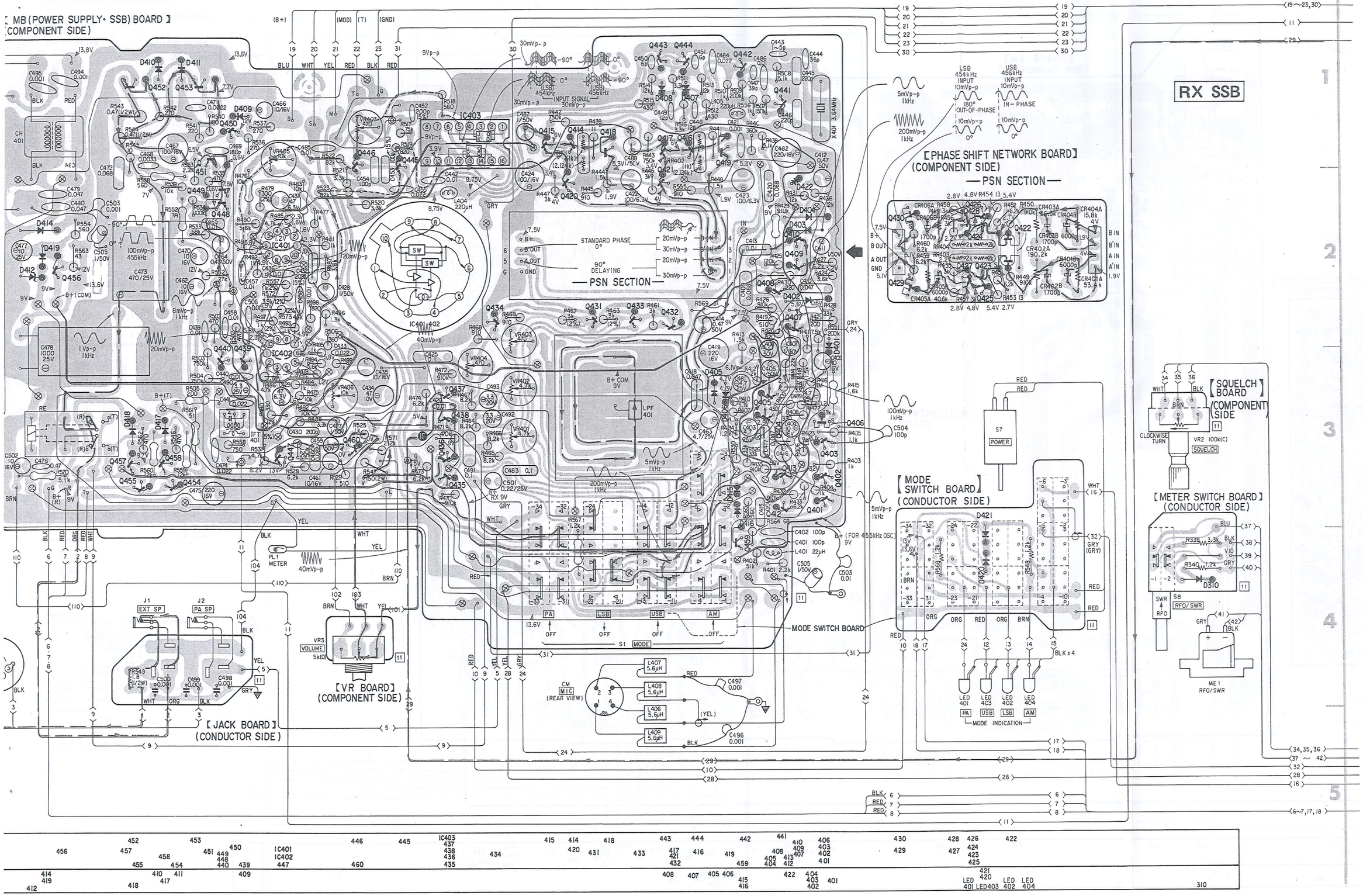
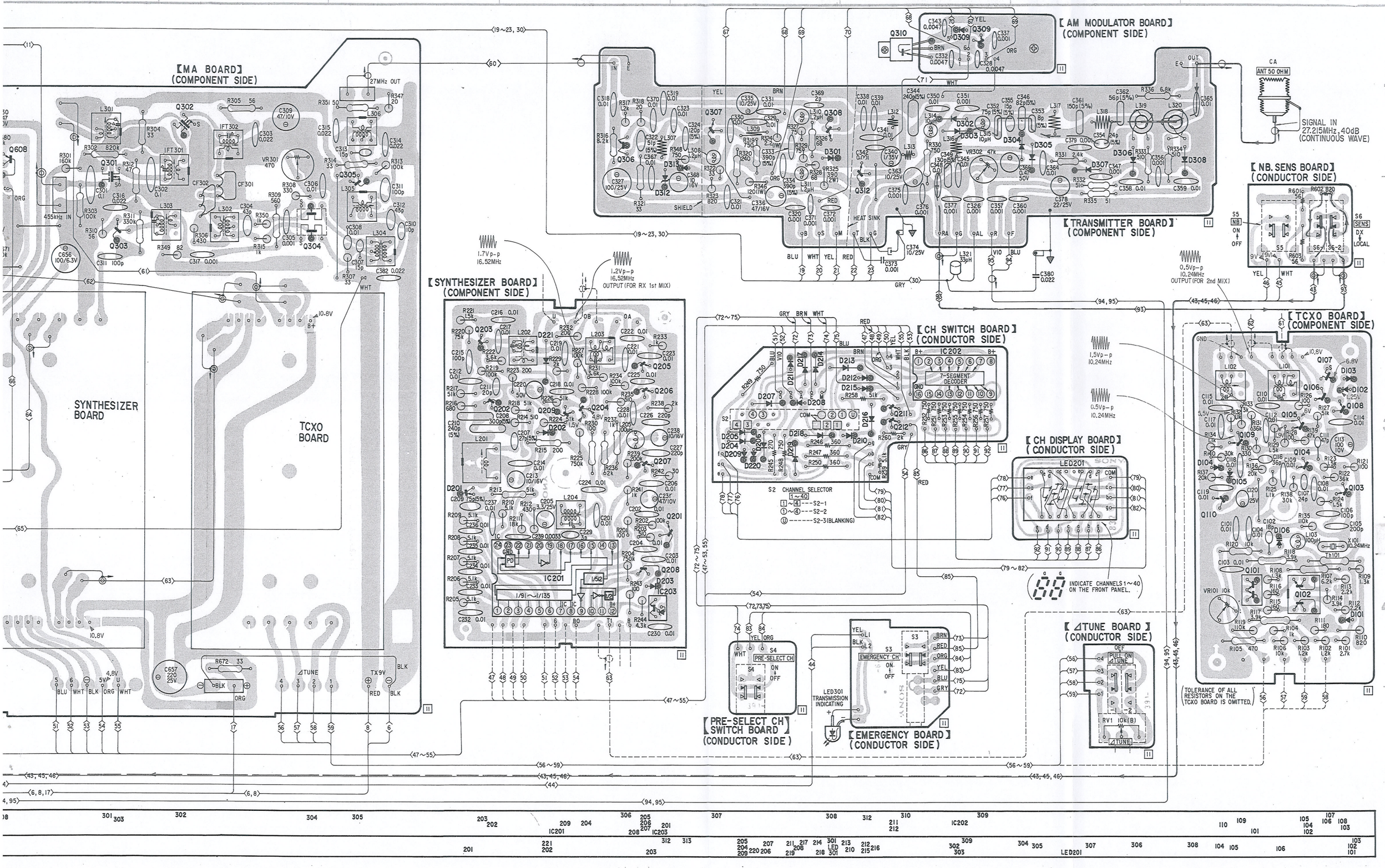
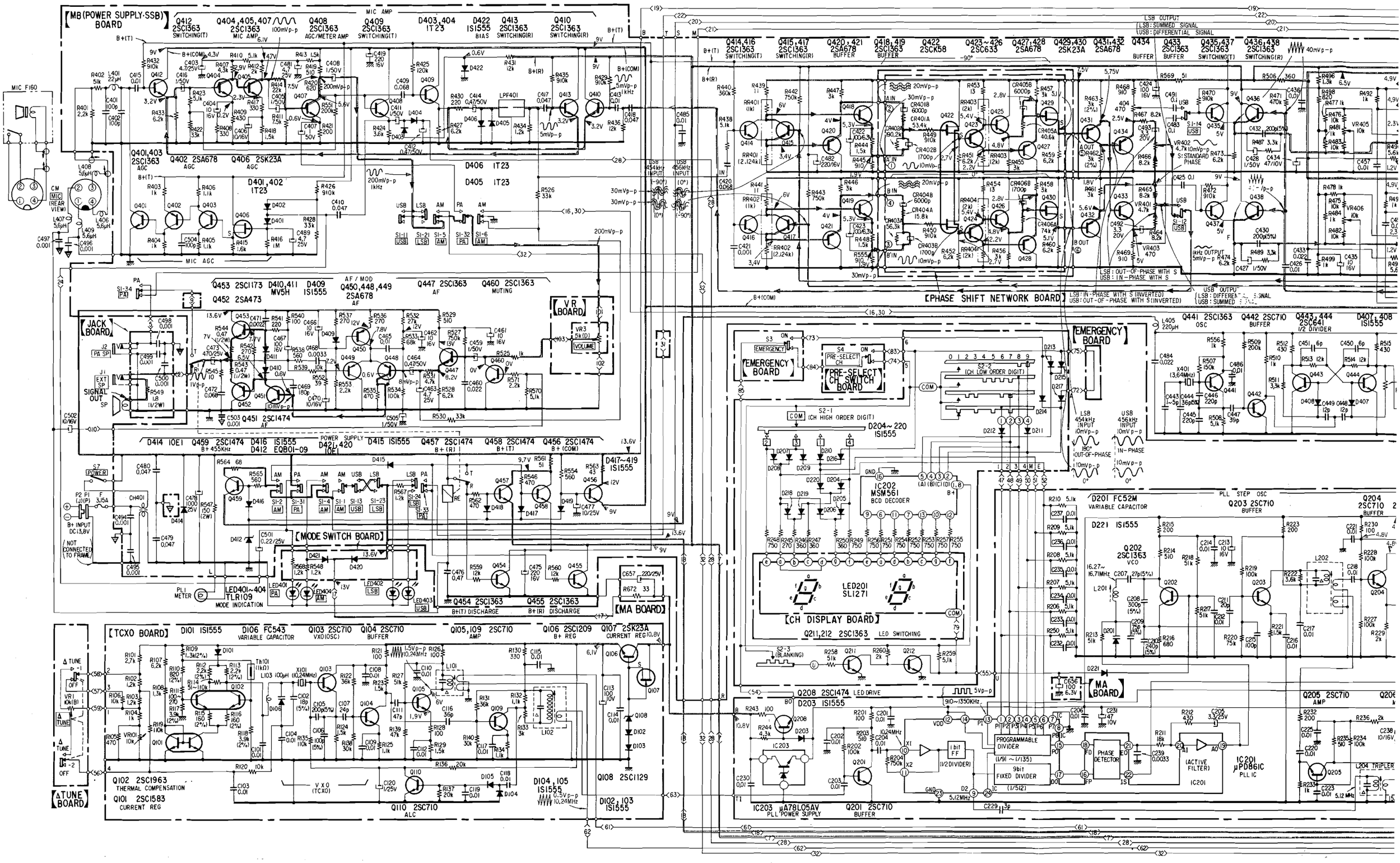

MB (POWER SUPPLY・SSB) BOARD
(COMPONENT SIDE)
(B+) (MOD) (T) (GND)
19 20 21 22 23 31
BLU WHT YEL RED BLK RED
IC403
IC401
IC402
PSN SECTION
STANDARD PHASE 0°
90° DELAYING
20mVp-p
30mVp-p
B+ COM 9V
LPF 401
MODE SWITCH BOARD
PA LSB USB AM
OFF
S1 MODE
CM MIC (REAR VIEW)
PL1 METER
J1 EXT SP
J2 PA SP
VR3 VOLUME 5kΩ
【VR BOARD】
(COMPONENT SIDE)
【JACK BOARD】
(CONDUCTOR SIDE)
【PHASE SHIFT NETWORK BOARD】
(COMPONENT SIDE)
— PSN SECTION —
2.8V 4.8V 5.4V 2.7V
【MODE SWITCH BOARD】
(CONDUCTOR SIDE)
S7 POWER
D421
LED 401 LED 403 LED 402 LED 404
MODE INDICATION
RX SSB
【SQUELCH BOARD】
(COMPONENT SIDE)
CLOCKWISE TURN
VR2 100k(C)
SQUELCH
【METER SWITCH BOARD】
(CONDUCTOR SIDE)
D310
S8 RFO/SWR
METER
RFO/SWR
LSB 454kHz INPUT 10mVp-p 180° OUT-OF-PHASE
USB 456kHz INPUT 10mVp-p IN-PHASE
5mVp-p 1kHz
200mVp-p 1kHz
100mVp-p 1kHz
40mVp-p
INPUT SIGNAL 30mVp-p
19~23,30
11
29
34,35,36
37 ~ 42
32
28
16
6~7,17,18


【MA BOARD】
(COMPONENT SIDE)
SYNTHESIZER BOARD
TCXO BOARD
【AM MODULATOR BOARD】
(COMPONENT SIDE)
【TRANSMITTER BOARD】
(COMPONENT SIDE)
【SYNTHESIZER BOARD】
(COMPONENT SIDE)
【NB. SENS BOARD】
(CONDUCTOR SIDE)
【TCXO BOARD】
(COMPONENT SIDE)
【CH SWITCH BOARD】
(CONDUCTOR SIDE)
【CH DISPLAY BOARD】
(CONDUCTOR SIDE)
【⊿TUNE BOARD】
(CONDUCTOR SIDE)
【PRE-SELECT CH】
SWITCH BOARD
(CONDUCTOR SIDE)
【EMERGENCY BOARD】
(CONDUCTOR SIDE)
ANT 50 OHM
SIGNAL IN
27.215MHz, 40dB
(CONTINUOUS WAVE)
27MHz OUT
455kHz IN
1.7Vp-p
16.52MHz
1.2Vp-p
16.52MHz
OUTPUT (FOR RX 1st MIX)
0.5Vp-p
10.24MHz
OUTPUT (FOR 2nd MIX)
1.5Vp-p
10.24MHz
0.5Vp-p
10.24MHz
10.8V
B+
4.8V
5V
⊿TUNE
TX9V
S2 CHANNEL SELECTOR
1~40
1~4 ---- S2-1
1~4 ---- S2-2
U ------ S2-3(BLANKING)
INDICATE CHANNELS 1~40
ON THE FRONT PANEL.
LED301
TRANSMISSION
INDICATING
EMERGENCY CH
PRE-SELECT CH
PULL ON ⊿TUNE
RV1 10k(B)
⊿TUNE
TOLERANCE OF ALL
RESISTORS ON THE
TCXO BOARD IS OMITTED.
IC201
IC202
IC203
LED201


MB (POWER SUPPLY·SSB) BOARD
MIC AMP
AGC/METER AMP
BIAS
MIC AGC
AF / MOD
AF
MUTING
POWER SUPPLY
MODE SWITCH BOARD
MODE INDICATION
B+(T) DISCHARGE
B+(R) DISCHARGE
PHASE SHIFT NETWORK BOARD
LSB OUTPUT
(LSB: SUMMED SIGNAL
USB: DIFFERENTIAL SIGNAL)
USB OUTPUT
(LSB: DIFFERENTIAL SIGNAL
USB: SUMMED SIGNAL)
LSB: IN-PHASE WITH S (INVERTED)
USB: OUT-OF-PHASE WITH S (INVERTED)
LSB: OUT-OF-PHASE WITH S
USB: IN-PHASE WITH S
JACK BOARD
VR BOARD
EMERGENCY BOARD
PRE-SELECT CH SWITCH BOARD
CH DISPLAY BOARD
MA BOARD
ΔTUNE BOARD
TCXO BOARD
VARIABLE CAPACITOR
VXO(OSC)
BUFFER
AMP
B+ REG
CURRENT REG
THERMAL COMPENSATION
CURRENT REG
ALC
VCO
LED SWITCHING
LED DRIVE
BCD DECODER
PLL STEP OSC
PLL IC
PLL POWER SUPPLY
MODE
OSC
1/2 DIVIDER
MIC
(REAR VIEW)
SIGNAL OUT
EXT SP
PA SP
POWER
B+ INPUT DC13.8V
(NOT CONNECTED TO FRAME)
METER
VOLUME
EMERGENCY
PRE-SELECT CH
(CH LOW ORDER DIGIT)
(CH HIGH ORDER DIGIT)
LED201 SL1271
LSB 454kHz INPUT 10mVp-p
USB 456kHz INPUT 10mVp-p
180° OUT-OF-PHASE
IN-PHASE
PROGRAMMABLE DIVIDER
(1/91 ~ 1/135)
9bit FIXED DIVIDER
(1/512)
1bit FF
(1/2 DIVIDER)
PHASE DETECTOR
(ACTIVE FILTER)
IC201 μPD861C
PLL IC
IC202 MSM561
IC203 μA78L05AV
D201 FC52M
VARIABLE CAPACITOR
D204~220 1S1555
D104,105 1S1555
D102,103 1S1555
D414 10E1
D412 EQB01-09
D42↓,420 10E1
Q401,403 2SC1363
Q402 2SA678
Q406 2SK23A
D401,402 1T23
D406 1T23
D405 1T23
Q412 2SC1363
Q404,405,407 2SC1363
Q408 2SC1363
Q409 2SC1363
D403,404 1T23
D422 1S1555
Q413 2SC1363
Q410 2SC1363
Q414,416 2SC1363
Q415,417 2SC1363
Q420,421 2SA678
Q418,419 2SC1363
Q422 2SCK58
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363
Q435,437 2SC1363
Q436,438 2SC1363
Q453 2SC1173
Q452 2SA473
D410,411 MV5H
D409 1S1555
Q450,448,449 2SA678
Q447 2SC1363
Q460 2SC1363
Q451 2SC1474
Q459 2SC1474
D416 1S1555
Q457 2SC1474
Q458 2SC1474
Q456 2SC1474
Q454 2SC1363
Q455 2SC1363
Q441 2SC1363
Q442 2SC710
Q443,444 2SC641
D407,408 1S1555
Q208 2SC1474
D203 1S1555
Q201 2SC710
Q203 2SC710
Q202 2SC1363
Q205 2SC710
Q101 2SC1583
Q102 2SC1963
Q108 2SC1129
Q110 2SC710
D101 1S1555
D106 FC543
Q103 2SC710
Q104 2SC710
Q105,109 2SC710
Q106 2SC1209
Q107 2SK23A
D101,402 1T23
D401 1T23
D402
D403
D404
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D417~419 1S1555
D420
D421
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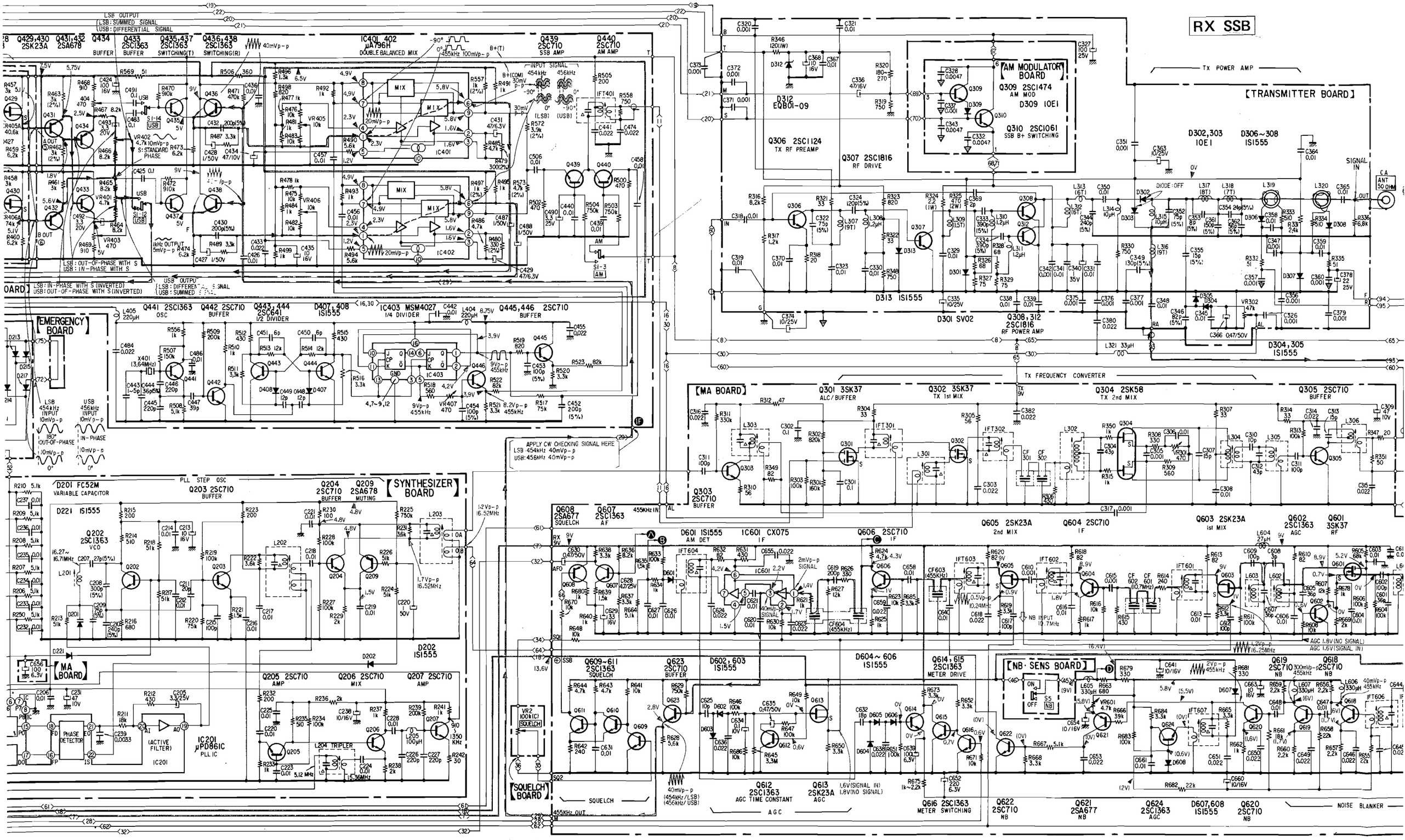
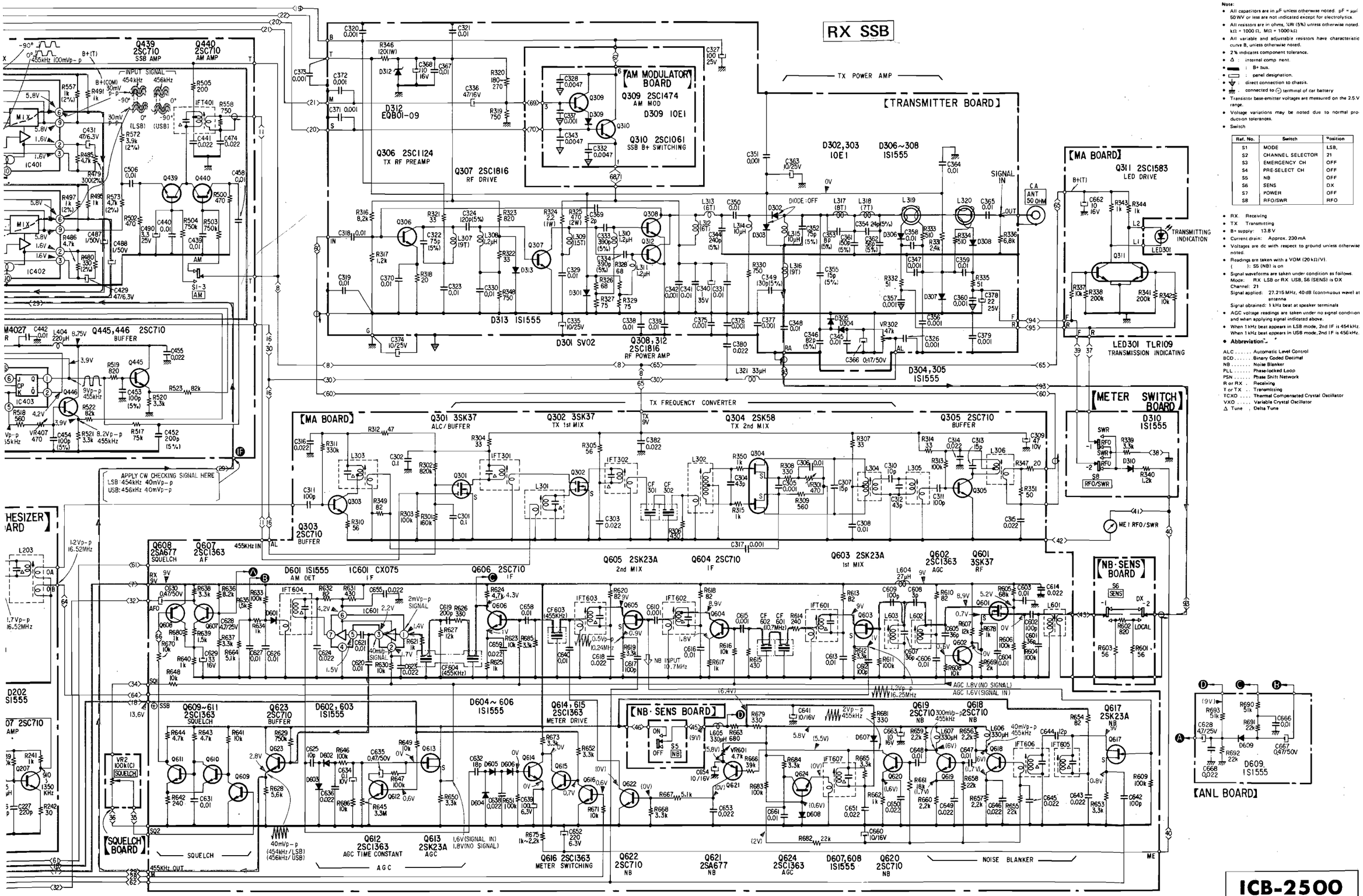
D458
D459


RX SSB
【TRANSMITTER BOARD】
【MA BOARD】
【EMERGENCY BOARD】
【SYNTHESIZER BOARD】
【SQUELCH BOARD】
【NB·SENS BOARD】
【AM MODULATOR BOARD】
Q306 2SC1124
TX RF PREAMP
Q307 2SC1816
RF DRIVE
Q308,312 2SC1816
RF POWER AMP
Q309 2SC1474
AM MOD
Q310 2SC1061
SSB B+ SWITCHING
D312 EQB01-09
D309 10E1
D313 1S1555
D301 SV02
D302,303 10E1
D306~308 1S1555
D304,305 1S1555
TX POWER AMP
TX FREQUENCY CONVERTER
Q301 3SK37
ALC/BUFFER
Q302 3SK37
TX 1st MIX
Q303 2SC710
BUFFER
Q304 2SK58
TX 2nd MIX
Q305 2SC710
BUFFER
IC401,402 μA796H
DOUBLE BALANCED MIX
Q429,430 2SK23A
Q431,432 2SA678
BUFFER
Q433 2SC1363
BUFFER
Q435,437 2SC1363
SWITCHING(T)
Q436,438 2SC1363
SWITCHING(R)
Q439 2SC710
SSB AMP
Q440 2SC710
AM AMP
LSB OUTPUT
(LSB:SUMMED SIGNAL
USB:DIFFERENTIAL SIGNAL
LSB:OUT-OF-PHASE WITH S
USB:IN-PHASE WITH S
LSB:IN-PHASE WITH S(INVERTED)
USB:OUT-OF-PHASE WITH S(INVERTED)
USB OUTPUT
(LSB:DIFFERENTIAL SIGNAL
USB:SUMMED SIGNAL
INPUT SIGNAL
454kHz
456kHz
(LSB)
(USB)
IFT401
MIX
IC401
IC402
AM
SSB
Q441 2SC1363
OSC
Q442 2SC710
BUFFER
Q443,444 2SC641
1/2 DIVIDER
D407,408 1S1555
IC403 MSM4027
1/4 DIVIDER
Q445,446 2SC710
BUFFER
X401 (3.64MHz)
IC403
Q445
Q446
LSB 454kHz INPUT 10mVp-p
USB 456kHz INPUT 10mVp-p
180° OUT-OF-PHASE
IN-PHASE
D221 1S1555
VARIABLE CAPACITOR
PLL STEP OSC
Q203 2SC710
BUFFER
Q204 2SC710
BUFFER
Q209 2SA678
MUTING
Q202 2SC1363
VCO
D202 1S1555
Q205 2SC710
AMP
Q206 2SC710
MIX
Q207 2SC710
AMP
IC201 μPD861C
PLL IC
PHASE DETECTOR
(ACTIVE FILTER)
APPLY CW CHECKING SIGNAL HERE
LSB:454kHz 40mVp-p
USB:456kHz 40mVp-p
Q608 2SA677
SQUELCH
Q607 2SC1363
AF
D601 1S1555
AM DET
IC601 CX075
IF
Q606 2SC710
IF
Q605 2SK23A
2nd MIX
Q604 2SC710
IF
Q603 2SK23A
1st MIX
Q602 2SC1363
AGC
Q601 3SK37
RF
Q609~611 2SC1363
SQUELCH
Q623 2SC710
BUFFER
D602,603 1S1555
D604~606 1S1555
Q614,615 2SC1363
METER DRIVE
Q619 2SC710
NB
Q618 2SC710
NB
Q612 2SC1363
AGC TIME CONSTANT
Q613 2SK23A
AGC
Q616 2SC1363
METER SWITCHING
Q622 2SC710
NB
Q621 2SA677
NB
Q624 2SC1363
AGC
D607,608 1S1555
Q620 2SC710
NB
SQUELCH
AGC
NOISE BLANKER
SIGNAL IN
ANT 50 OHM
DIODE:OFF
NB INPUT 10.7MHz
40mVp-p (454kHz/LSB) (456kHz/USB)
455KHz OUT
455KHz IN



Note:

- All capacitors are in μF unless otherwise noted. pF = μμF
  50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted.
  kΩ = 1000 Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- Δ : internal comp nent.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏦ : connected to ⊖ terminal of car battery
- Transistor base-emitter voltages are measured on the 2.5-V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

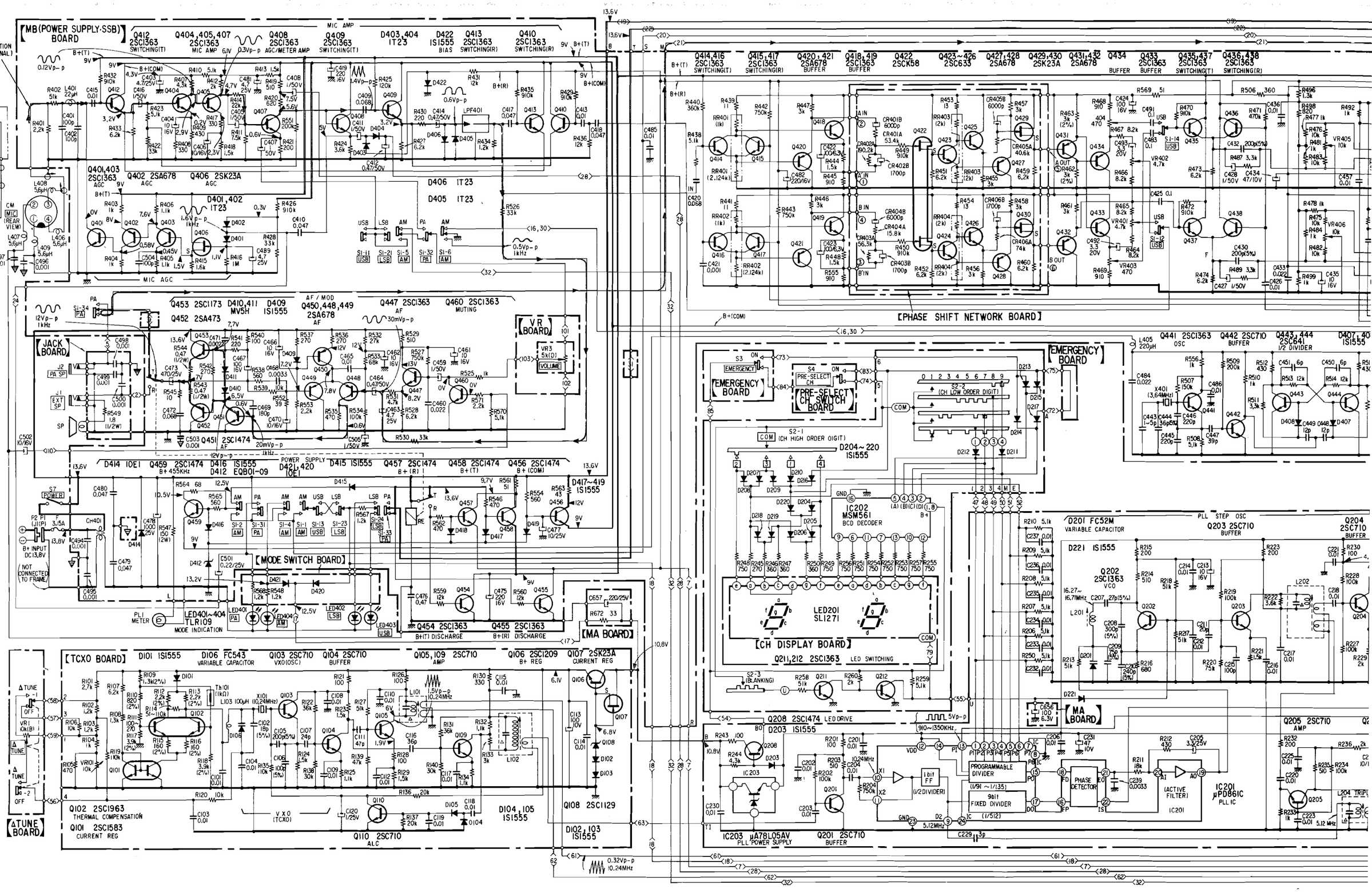
Ref. No.	Switch	Position
S1	MODE	LSB,
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

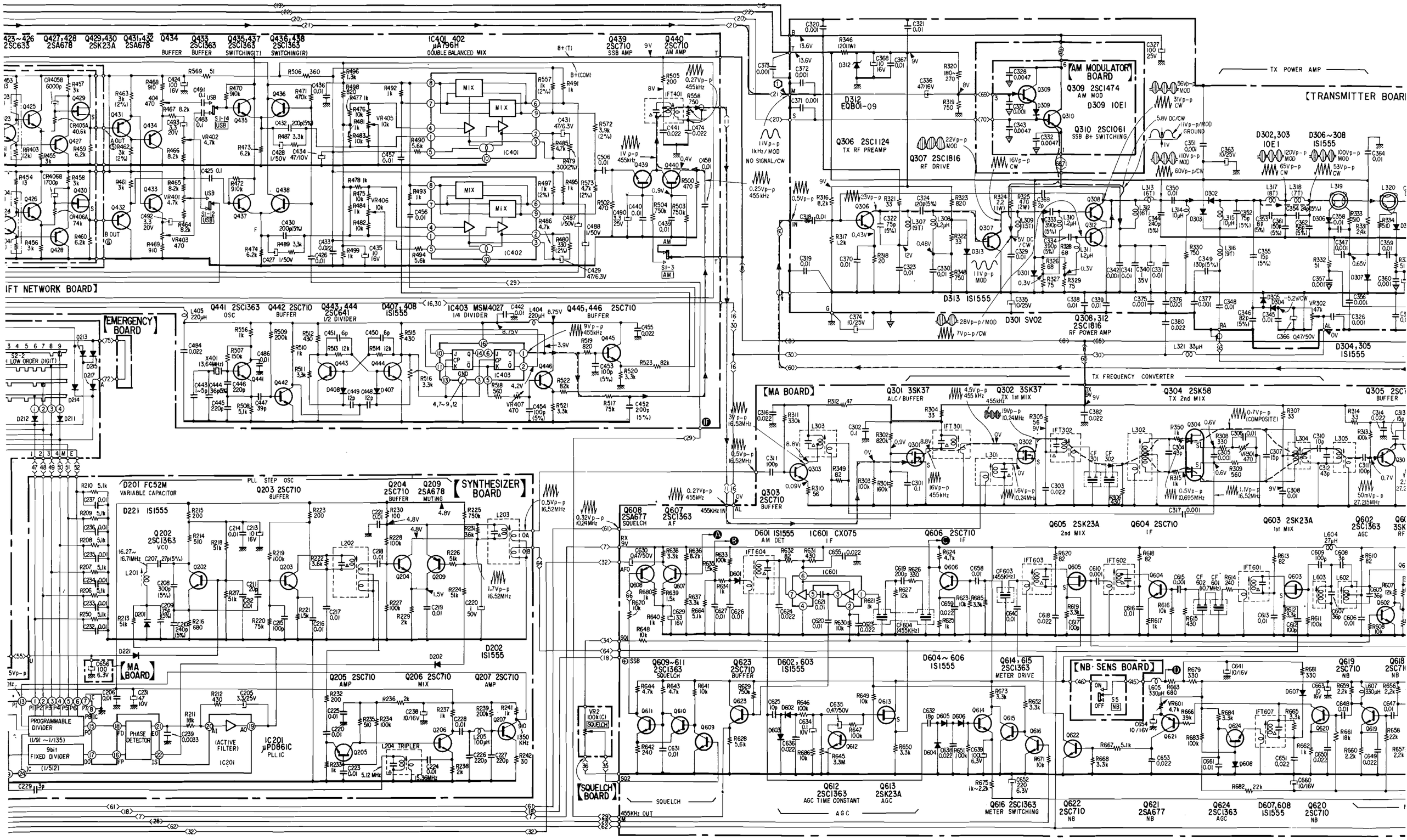
- RX : Receiving
- TX : Transmitting
- B+ supply: 13.8 V
- Current drain: Approx. 230 mA
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
  ( ): S6 (NB) is on
- Signal waveforms are taken under condition as follows.
  Mode: RX LSB or RX USB, S6 (SENS) is DX
  Channel: 21
  Signal applied: 27.215 MHz, 40 dB (continuous wave) at antenna
  Signal obtained: 1 kHz beat at speaker terminals
- AGC voltage readings are taken under no signal condition and when applying signal indicated above.
- When 1 kHz beat appears in LSB mode, 2nd IF is 454 kHz. When 1 kHz beat appears in USB mode, 2nd IF is 456 kHz.

- **Abbreviation**

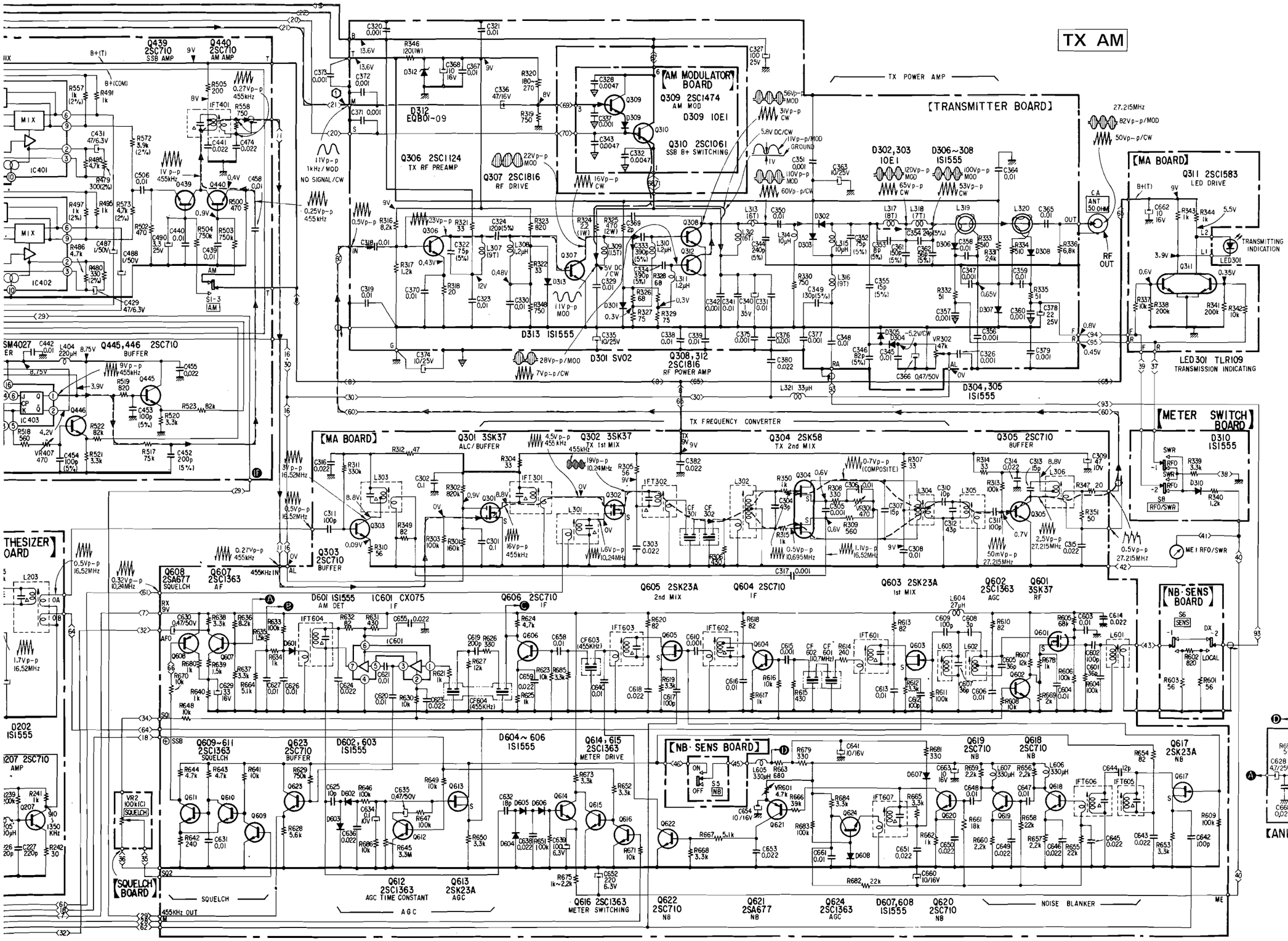
ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX . Receiving
T or TX . Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO .... Variable Crystal Oscillator
Δ Tune . Delta Tune

ICB-2500


[MB(POWER SUPPLY-SSB) BOARD]
MIC AMP
Q412 2SC1363 SWITCHING(T)
Q404,405,407 2SC1363 MIC AMP
Q408 2SC1363 AGC/METER AMP
Q409 2SC1363 SWITCHING(T)
D403,404 1T23
D422 1S1555 BIAS
Q413 2SC1363 SWITCHING(R)
Q410 2SC1363 SWITCHING(R)
Q414,416 2SC1363 SWITCHING(T)
Q415,417 2SC1363 SWITCHING(R)
Q420,421 2SA678 BUFFER
Q418,419 2SC1363 BUFFER
Q422 2SK58 BUFFER
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
Q401,403 2SC1363 AGC
Q402 2SA678 AGC
Q406 2SK23A AGC
D401,402 1T23
D406 1T23
D405 1T23
MIC AGC
[PHASE SHIFT NETWORK BOARD]
Q453 2SC1173 D410,411 MV5H D409 1S1555 Q450,448,449 2SA678 AF
Q452 2SA473
Q447 2SC1363 AF
Q460 2SC1363 MUTING
[JACK BOARD]
[VR BOARD]
VR3 5K(Ω) VOLUME
Q451 2SC1474 AF
[MODE SWITCH BOARD]
LED401~404 TLR109 MODE INDICATION
[MA BOARD]
Q454 2SC1363 B+(T) DISCHARGE
Q455 2SC1363 B+(R) DISCHARGE
[EMERGENCY BOARD]
[PRE-SELECT CH SWITCH BOARD]
D204~220 1S1555
IC202 MSM561 BCD DECODER
[CH DISPLAY BOARD]
LED201 SL1271
Q211,212 2SC1363 LED SWITCHING
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407 1S1555
D414 1OE1 Q459 2SC1474 B+ 455KHz
D416 1S1555 D412 EQB01-09
D421,420 1OE1 POWER SUPPLY
D415 1S1555
Q457 2SC1474 B+(R)
Q458 2SC1474 B+(T)
Q456 2SC1474 B+(COM)
D417~419 1S1555
[TCXO BOARD]
D101 1S1555 VARIABLE CAPACITOR
D106 FC543
Q103 2SC710 VXO(OSC)
Q104 2SC710 BUFFER
Q105,109 2SC710 AMP
Q106 2SC1209 B+ REG
Q107 2SK23A CURRENT REG
[ΔTUNE BOARD]
Q102 2SC1963 THERMAL COMPENSATION
Q101 2SC1583 CURRENT REG
Q110 2SC710 ALC
D104,105 1S1555
Q108 2SC1129
D102,103 1S1555
IC203 μA78L05AV PLL POWER SUPPLY
Q201 2SC710 BUFFER
IC201 μPD861C PLL IC
D201 FC52M VARIABLE CAPACITOR
PLL STEP OSC
Q203 2SC710 BUFFER
Q204 2SC710 BUFFER
D221 1S1555
Q202 2SC1363 VCO
Q205 2SC710 AMP
[MA BOARD]
MIC F160
CM (MIC REAR VIEW)
PA SP
EXT SP
SP
B+ INPUT DC13.8V
PLL METER
1kHz, -20dB FOR MODULATION (CW: NO SIGNAL)


Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
IC401 402 μA796H DOUBLE BALANCED MIX
Q439 2SC710 SSB AMP
Q440 2SC710 AM AMP
IFT NETWORK BOARD
EMERGENCY BOARD
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407,408 1SI555
IC403 MSM4027 1/4 DIVIDER
Q445,446 2SC710 BUFFER
PROGRAMMABLE DIVIDER (1/91 ~ 1/135)
9bit FIXED DIVIDER (1/512)
PHASE DETECTOR
(ACTIVE FILTER)
IC201 μPD861C PLL IC
PLL STEP OSC
D201 FC52M VARIABLE CAPACITOR
Q203 2SC710 BUFFER
Q204 2SC710 BUFFER
Q209 2SA678 MUTING
SYNTHESIZER BOARD
D221 1SI555
Q202 2SC1363 VCO
D202 1SI555
Q205 2SC710 AMP
Q206 2SC710 MIX
Q207 2SC710 AMP
MA BOARD
AM MODULATORY BOARD
Q309 2SC1474 AM MOD
D309 10E1
Q310 2SC1061 SSB B+ SWITCHING
D312 EQB01-09
Q306 2SC1124 TX RF PREAMP
Q307 2SC1816 RF DRIVE
D313 1SI555
D301 SV02
Q308,312 2SC1816 RF POWER AMP
TX POWER AMP
TRANSMITTER BOARD
D302,303 10E1
D306~308 1SI555
D304,305 1SI555
TX FREQUENCY CONVERTER
MA BOARD
Q301 3SK37 ALC/BUFFER
Q302 3SK37 TX 1st MIX
Q304 2SK58 TX 2nd MIX
Q305 2SC7 BUFFER
Q303 2SC710 BUFFER
Q608 2SA677 SQUELCH
Q607 2SC1363 AF
D601 1SI555 AM DET
IC601 CX075 IF
Q606 2SC710 IF
Q605 2SK23A 2nd MIX
Q604 2SC710 IF
Q603 2SK23A 1st MIX
Q602 2SC1363 AGC
SQUELCH BOARD
Q609~611 2SC1363 SQUELCH
Q623 2SC710 BUFFER
D602,603 1SI555
D604~606 1SI555
Q614,615 2SC1363 METER DRIVE
NB·SENS BOARD
Q612 2SC1363 AGC TIME CONSTANT
Q613 2SK23A AGC
Q616 2SC1363 METER SWITCHING
Q622 2SC710 NB
Q621 2SA677 NB
Q624 2SC1363 AGC
D607,608 1SI555
Q620 2SC710 NB
SQUELCH
AGC

TX AM



Note

- All capacitors are in μF unless otherwise noted. pF = μμF. 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

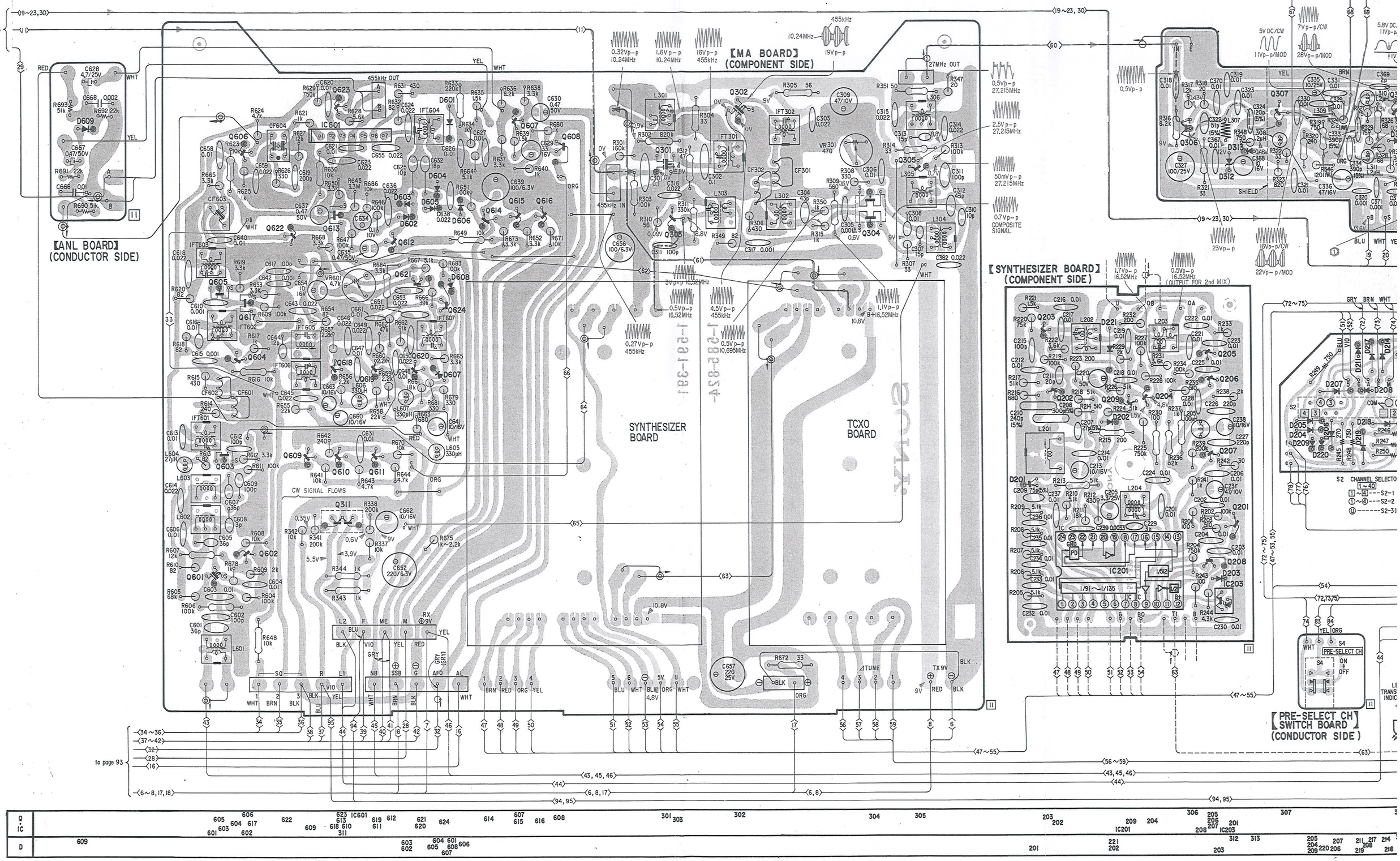
Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  1.75A .....antenna load 50Ω (NO MODULATION)
  1.7A .....antenna load 50Ω (1 kHz, −20 dB signal is applied at microphone input)
- Voltages are dc with respect to ground unless otherwise noted.
- Voltage readings and signal waveforms in RF vounger stage are taken with no modulation (Be sure to cut the porrion Ⓐ.). In MIC AMP, AM MODULATION and TX POWER AMP sections, they are taken with modulation (1 kHz, −20 dB signal is applied at microphone input) and with no modulation.
  MOD: with modulation
  CW (continuous wave): with no modulation

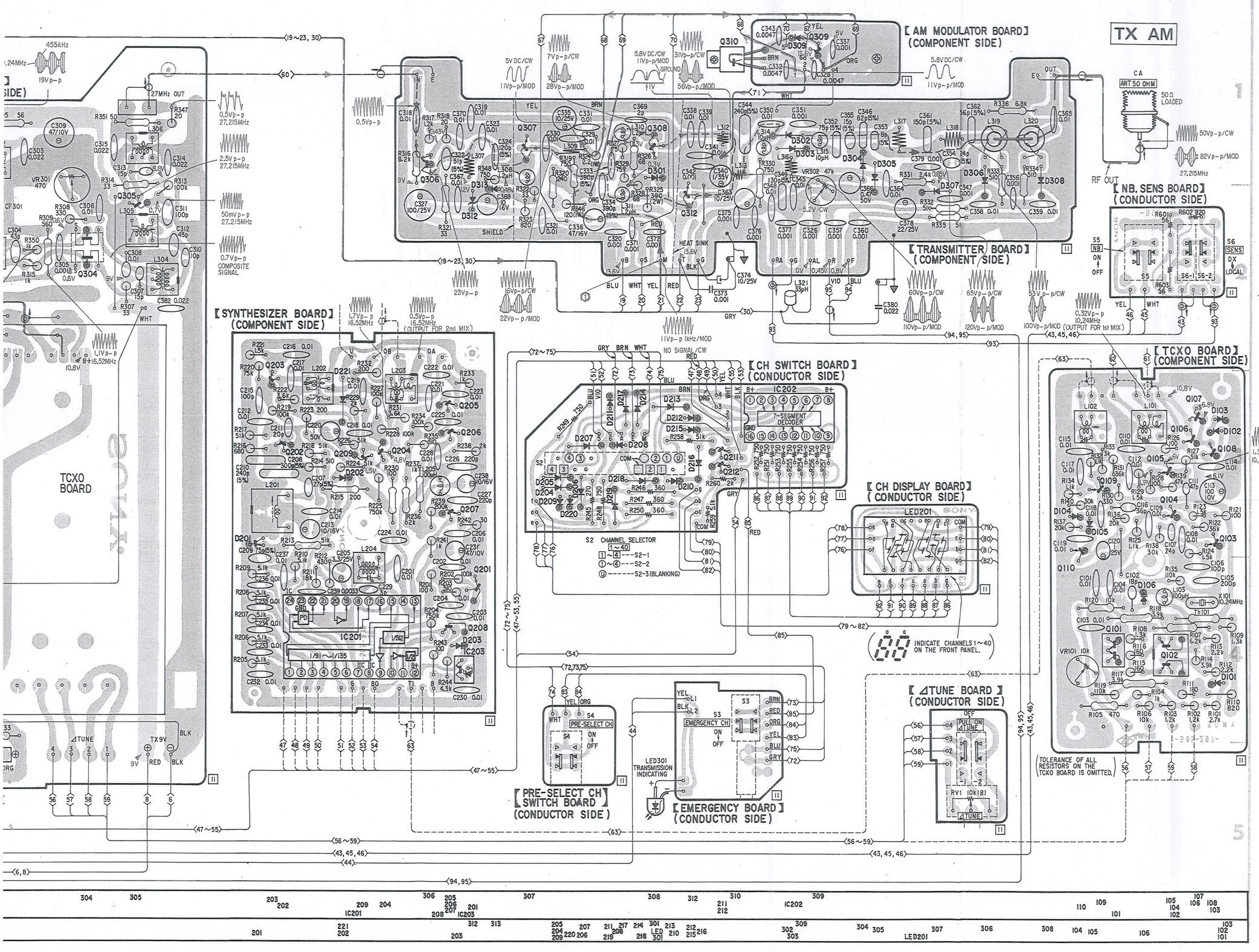
- **Abbreviation**

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
△ Tune .. Delta Tune

4-11. MOUNTING DIAGRAM — Synthesizer and Frequency Converter Section; TX AM —



Q・IC	601 603 602 604 606 605 617 622 609 623 613 618 610 311 IC601 619 611 612 621 620 624 614 607 615 616 608 301 303 302 304 305 203 202 209 204 IC201 306 205 206 207 208 201 IC203 307
D	609 603 602 604 605 607 606 201 221 202 203 312 313 205 204 209 207 220 206 211 217 208 219 214 218



Replacement Semiconductors

Q101, 311: 2SC1583

Q102: 2SC1963

Q103 – 105, 109, 110
Q201, 203 – 207,
Q303, 305
Q604, 606, 618 – 620
Q622, 623
: 2SC710

Q106: 2SC1209

Q107, 603
Q605, 617
Q613: 2SK23A-824 (2SK23A)
: 2SK23A-860 (2SK23A)

Q108: 2SC1129

Q202, 211, 212
Q602, 607, 609 – 612
Q614 – 616, 624
: 2SC634A (2SC1363)

Q208, 309: 2SC1474

Q209: 2SA678
Q608, 621: 2SA678 (2SA677)

Q301, 302, 601: 3SK37

Q304: 2SK58

Q306: 2SC1124

Q307, 308, 312: 2SC1816

Q310: 2SC1061

D101 – 105, 202 – 221
D304 – 309, 313
D601 – 609
D106: FC543
D201: FC52C (FC52M)
D302, 303, 309: 10E2 (10E1)
: 1S1555

D301: SV02

D312: EQB01-09

IC201: μPD861C

IC202: MSM561

IC203: μA78L05AV

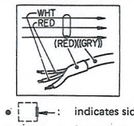
IC601: CX075B (CX075)

LED201: SL1272

LED301: TLR109

Note:

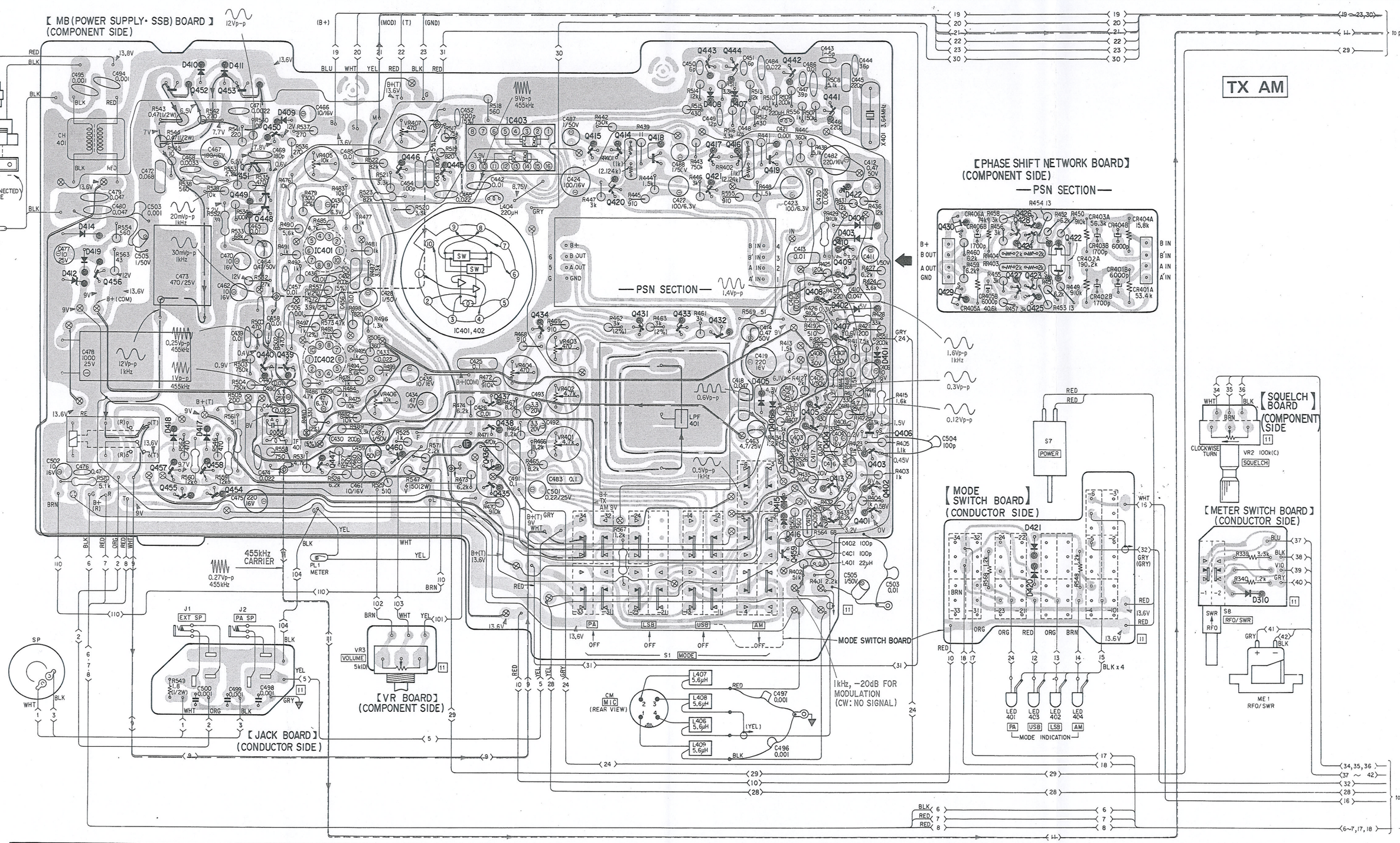
- Color code of sleeving over the end of the jacket.



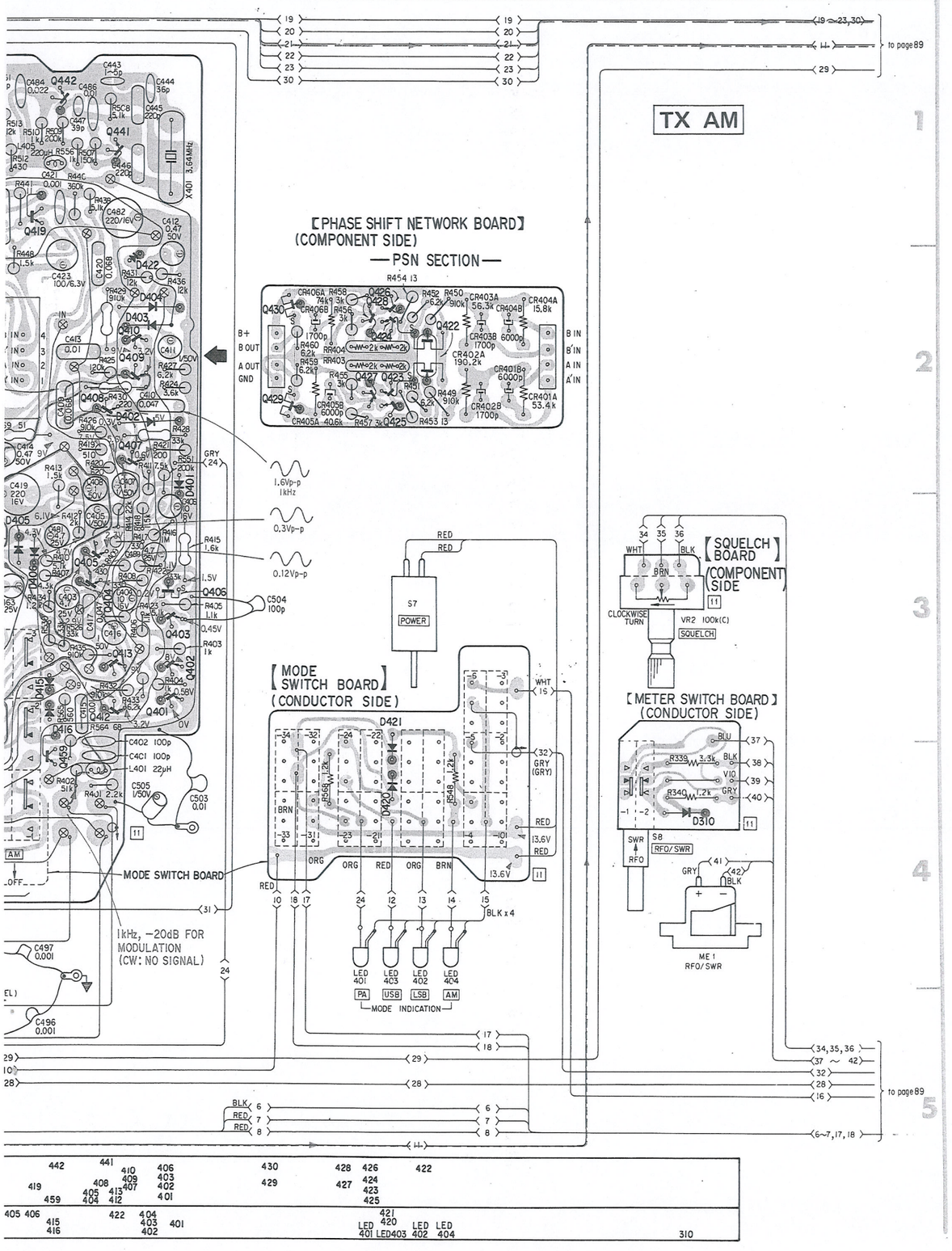
- ⊏⊐: indicates side identified with part number.
- : B+ pattern
- Signal Path
  - ——→: MAIN SIGNAL
  - - - - →: 455 kHz
  - —·—→: 10.24 MHz
  - —··—→: 16.52 MHz

- Voltage readings and signal waveforms in RF younger stage are taken with no modulation (Be sure to cut the portion ⓘ). In MIC AMP, AM MODULATION and TX POWER AMP sections, they are taken with modulation (1 kHz, −20 dB signal is applied at microphone input) and with no modulation.

MOD: with modulation
CW (continuous wave): with no modulation


【 MB (POWER SUPPLY・SSB) BOARD 】
(COMPONENT SIDE)
TX AM
【PHASE SHIFT NETWORK BOARD】
(COMPONENT SIDE)
— PSN SECTION —
【 SQUELCH BOARD 】
(COMPONENT SIDE)
【 METER SWITCH BOARD 】
(CONDUCTOR SIDE)
【 MODE SWITCH BOARD 】
(CONDUCTOR SIDE)
【 JACK BOARD 】
(CONDUCTOR SIDE)
【 VR BOARD 】
(COMPONENT SIDE)
MODE SWITCH BOARD
MODE INDICATION
1kHz, −20dB FOR MODULATION (CW: NO SIGNAL)
455kHz CARRIER
2P CONNECTOR
B+ INPUT DC 13.8V
(NOT CONNECTED TO FRAME)
IC401, 402
IC403
X401 3.64MHz
LPF 401
S7 POWER
S1 (MODE)
PA
LSB
USB
AM
CM MIC (REAR VIEW)
SP
J1 EXT SP
J2 PA SP
VR3 VOLUME 5kΩ
PL1 METER
S8 RFO/SWR
ME1 RFO/SWR
SQUELCH
CLOCKWISE TURN
VR2 100k(C)
to page 89

| | | |



Replacement Semiconductors

For replacement, use semiconductors except in ( ).

Q439, 440, 442, Q445, 446: 2SC710

Q453: 2SC1173

D310
D407—409, 415—419: 1S1555
D422
D414, 420, 421: 10E2 (10E1)
D401—406: 1T22A (1T23)

Q406: 2SK23A-824 (2SK23A)
Q429, 430: 2SK23A-812 (2SK23A)

Q401, 403—405
Q407—410, 412—419
Q433, 435—438, 441
Q447, 454, 455, 460
Q602, 607, 609—612
Q614—616, 624
: 2SC634A (2SC1363)

D412: EQB01-09

Q451, 456 ~459: 2SC1474

D410, 411: VD1120 (MV5H)

Q402, 420, 421, 427
Q428, 431, 432, 434
Q448—450
: 2SA678

IC401, 402: μA796HC

Q422: 2SK58

IC403: MSM4027

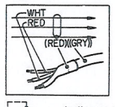
LED401—404: TLR109

Q423—426: 2SC634A (2SC633)

Q443, 444: 2SC641K (2SC641)

Q452: 2SA473

Note:
- Color code of sleeving over the end of the jacket.



- : indicates side identified with part number.
- Through hole
- Component side pattern
- component side B+ pattern
- : B+ pattern
- Signal Path
  - : MAIN SIGNAL
  - : 455 kHz
  - : 10.24 MHz
  - : 16.52 MHz

Note: (for schematic diagram)

- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ = 1000Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	AM
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  - 1.75A .....antenna load 50Ω (NO MODULATION)
  - 1.7A .....antenna load 50Ω (1 kHz, −20 dB signal is applied at microphone input)
- Voltages are dc with respect to ground unless otherwise noted.
- Voltage readings and signal waveforms in RF younger stage are taken with no modulation (Be sure to cut the portion (1).). In MIC AMP, AM MODULATION and TX POWER AMP sections, they are taken with modulation (1 kHz, −20 dB signal is applied at microphone input) and with no modulation.

  MOD: with modulation
  CW (continuous wave): with no modulation

● Abbreviation

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
Δ Tune .. Delta Tune

4-13. MOUNTING DIAGRAM — Power Supply and SSB Generator Section; TX SSB —

Replacement Semiconductors

Note: (for schematic diagram)

- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ =1000Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	LSB,
S2	CHANNEL SELECTOR	21
S3	EMERGENCY -CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  1.2A ..... antenna load 50Ω (1 kHz, approx. −60dB signal is applied at microphone input and 40 Vp-p signal appears at antenna.)
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
- Signal waveforms are taken under the following condition.
  Mode: TX LSB or TX USB, S6 (SENS) is DX and △ tune is off.
  Channel: 21
- Frequency of 455 kHz SSB signal is SSB GENERATOR section is accuretely 454 kHz in TX LSB mode and 456 kHz in TX USB mode.

● Abbreviation

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
△ Tune .. Delta Tune

Q439, 440, 442, Q445, 446: 2SC710

Q406: 2SK23A-824 (2SK23A)
Q429, 430: 2SK23A-812 (2SK23A)

Q401, 403–405
Q407–410, 412–419
Q433, 435–438, 441
Q447, 454, 455, 460
Q602, 607, 609–612
Q614–616, 624
: 2SC634A (2SC1363)

Q451, 456 ~459 : 2SC1474

Q402, 420, 421, 427
Q428, 431, 432, 434
Q448–450
: 2SA678

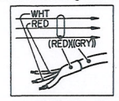
Q422: 2SK58

Q423–426: 2SC634A (2SC633)

Q443, 444: 2SC641K (2SC641)

Q452: 2SA473

Note:
- Color code of sleeving over the end of the jacket.



- □: indicates side identified with part number.
- ⊗ Through hole
  Component side pattern
- ⊗ component side B+ pattern
- ▬ : B+ pattern
- Signal Path
  —→: SIGNAL
  ----→: 455 kHz CARRIER

Q453: 2SC1173

D310
D407–409, 415–419
D422,
D414, 420, 421: 10E2 (10E1)
D401–406: 1T22A (1T23)
: 1S1555

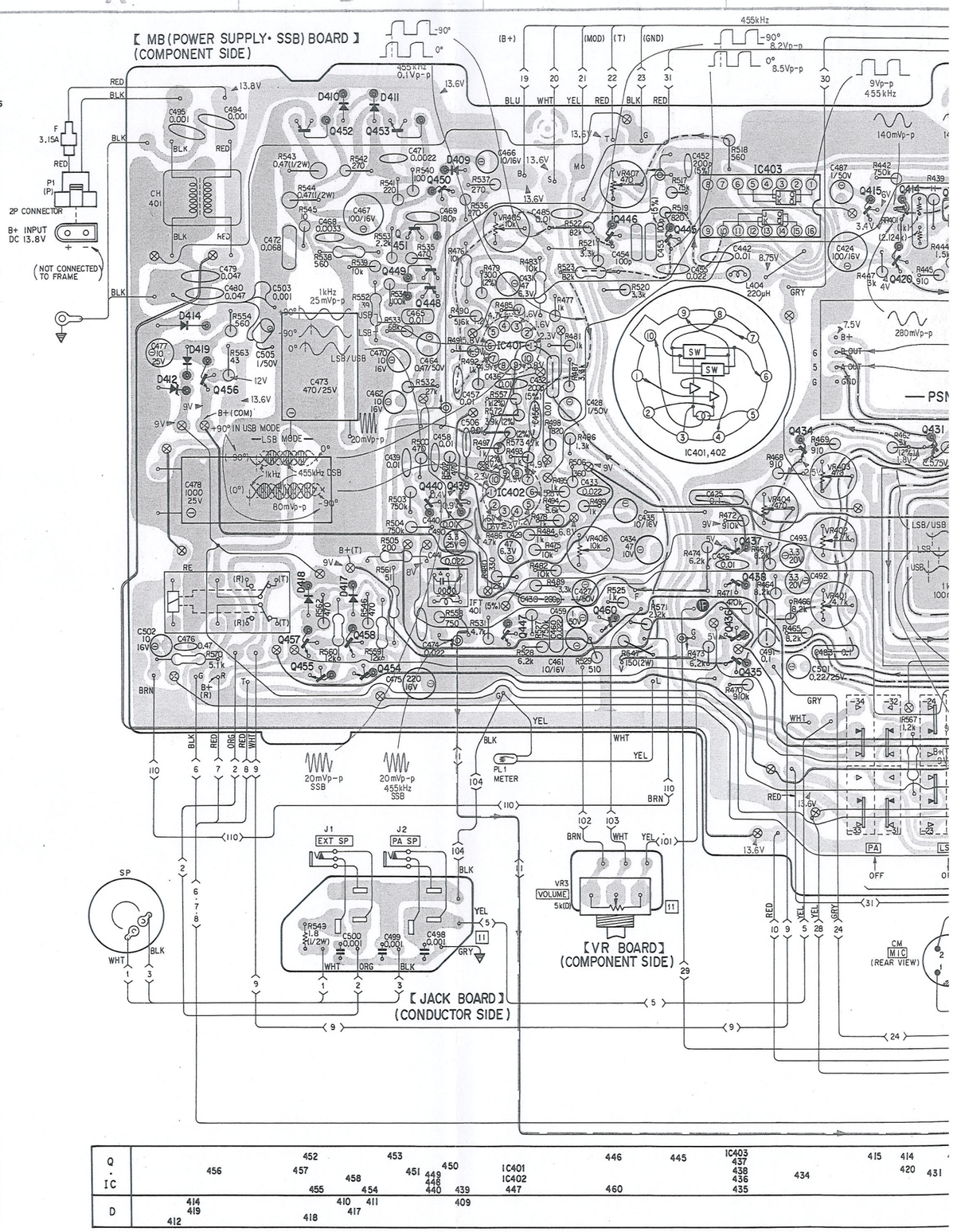
D412: EQB01-09

D410, 411: VD1120 (MV5H)

IC401, 402: μA796HC

IC403: MSM4027

LED401–404: TLR109



Q・IC	456	457	452	455	458	454	453	451	449	448	440	450	439	IC401	IC402	447	446	460	445	IC403	437	438	436	435	434	415	414	420	431
D	412	414	419	418	410	417	411	409																					

4-13. MOUNTING DIAGRAM — Power Supply and SSB Generator Section; TX SSB —

Replacement Semiconductors

Q439, 440, 442, 445, 446 : 2SC710

Q406: 2SK23A-824 (2SK23A)
Q429, 430: 2SK23A-812 (2SK23A)

Q401, 403–405
Q407–410, 412–419
Q433, 435–438, 441
Q447, 454, 455, 460
Q602, 607, 609–612
Q614–616, 624
: 2SC634A (2SC1363)

Q451, 456 ~459 : 2SC1474

Q402, 420, 421, 427
Q428, 431, 432, 434
Q448–450
: 2SA678

Q422: 2SK58

Q423–426: 2SC634A (2SC633)

Q443, 444: 2SC641K (2SC641)

Q452: 2SA473

Q453: 2SC1173

D310
D407–409, 415–419
D422,
D414, 420, 421: 10E2 (10E1)
D401–406: 1T22A (1T23)
: 1S1555

D412: EQB01-09

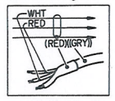
D410, 411: VD1120 (MV5H)

IC401, 402: μA796HC

IC403: MSM4027

LED401–404: TLR109

Note:
- Color code of sleeving over the end of the jacket.



- : indicates side identified with part number.
- Through hole
- Component side pattern
- component side B+ pattern
- : B+ pattern
- Signal Path
  - SIGNAL
  - 455 kHz CARRIER

Note: (for schematic diagram)

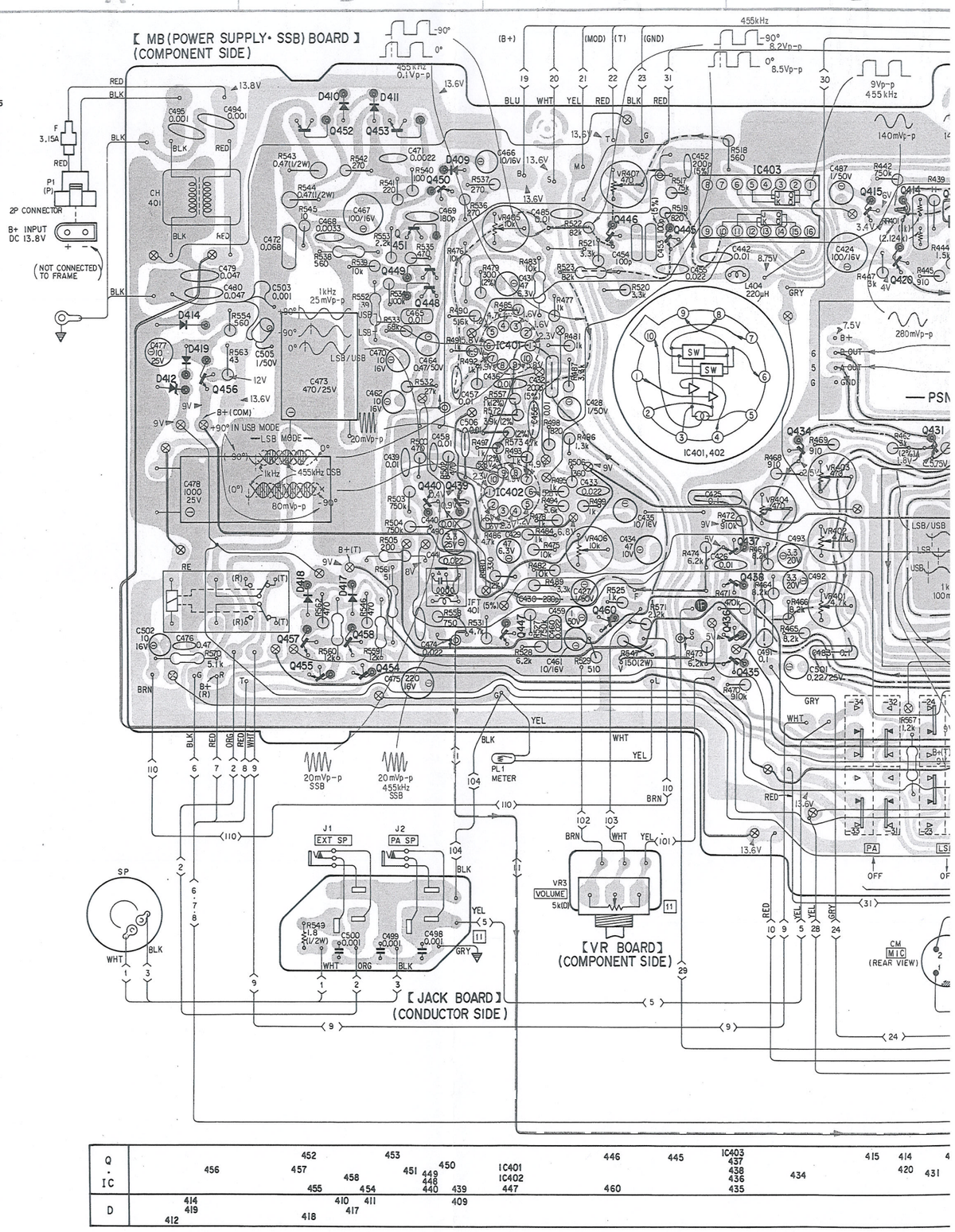
- All capacitors are in μF unless otherwise noted. pF = μμF 50 WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W (5%) unless otherwise noted. kΩ =1000Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component.
- ▬ : B+ bus.
- ▭ : panel designation.
- ⏚ : direct connection to chassis.
- ⏚ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	LSB,
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

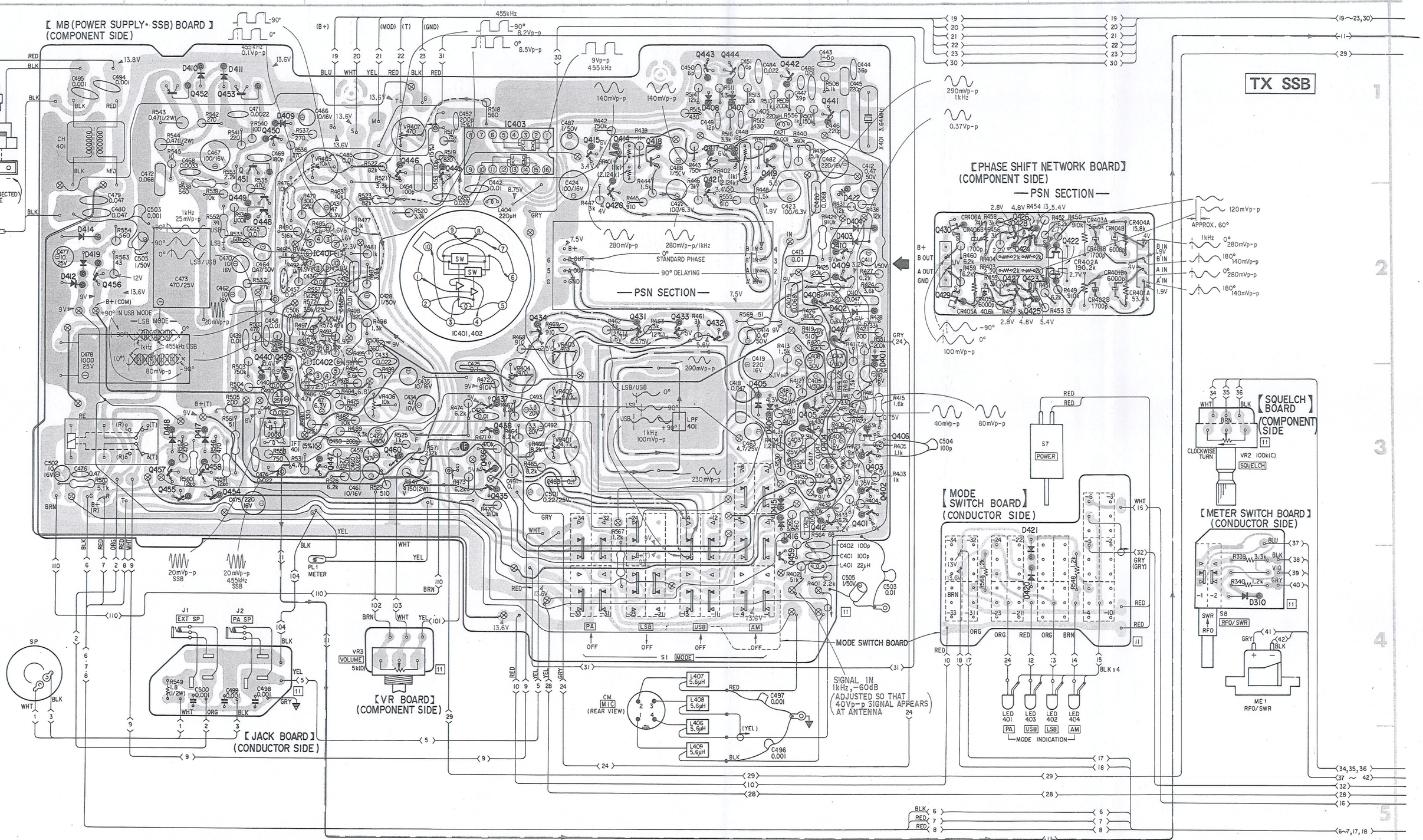
- RX: Receiving
- TX: Transmitting
- B+ supply: 13.8 V
- Current drain:
  1.2 A ..... antenna load 50Ω (1 kHz, approx. −60dB signal is applied at microphone input and 40 Vp-p signal appears at antenna.)
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
- Signal waveforms are taken under the following condition.
  Mode: TX LSB or TX USB, S6 (SENS) is DX and △ tune is off.
  Channel: 21
- Frequency of 455 kHz SSB signal is SSB GENERATOR section is accurately 454 kHz in TX LSB mode and 456 kHz in TX USB mode.

● Abbreviation

ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
△ Tune .. Delta Tune



	A	B	C	D
Q・IC	456	452 453 457 458 455 454 451 450 449 446 448 440 439	445 IC401 IC402 447	446 460 IC403 437 438 436 435 434 415 414 420 431
D	414 419 412	410 411 417 418 409		


【 MB (POWER SUPPLY・SSB) BOARD 】
(COMPONENT SIDE)
— PSN SECTION —
STANDARD PHASE
90° DELAYING
IC401, 402
【PHASE SHIFT NETWORK BOARD】
(COMPONENT SIDE)
— PSN SECTION —
TX SSB
【SQUELCH】 BOARD
(COMPONENT SIDE)
【METER SWITCH BOARD】
(CONDUCTOR SIDE)
【MODE SWITCH BOARD】
(CONDUCTOR SIDE)
MODE SWITCH BOARD
【JACK BOARD】
(CONDUCTOR SIDE)
【VR BOARD】
(COMPONENT SIDE)
SIGNAL IN
1kHz, −60dB
(ADJUSTED SO THAT
40Vp-p SIGNAL APPEARS
AT ANTENNA
MODE INDICATION
ME1
RFO/SWR

| | | |

4-14. MOUNTING DIAGRAM — Synthesizer and Frequency Converter Section; TX SSB —

Replacement Semiconductors

Q101, 311: 2SC1583

Q102: 2SC1963

Q103 – 105, 109, 110
Q201, 203 – 207,
Q303, 305
Q604, 606, 618 – 620
Q622, 623
: 2SC710

Q106: 2SC1209

Q107, 603 : 2SK23A-824 (2SK23A)
Q605, 617
Q613: 2SK23A-860 (2SK23A)

Q108: 2SC1129

Q202, 211, 212
Q602, 607, 609 – 612
Q614 – 616, 624
: 2SC634A (2SC1363)

IC201: μPD861C

IC202: MSM561

IC203: μA78L05AV

Q208, 309: 2SC1474

IC601: CX075B (CX075)

Q209: 2SA678
Q608, 621: 2SA678 (2SA677)

LED201: SL1272

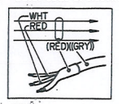
Q301, 302, 601: 3SK37

LED301: TLR109

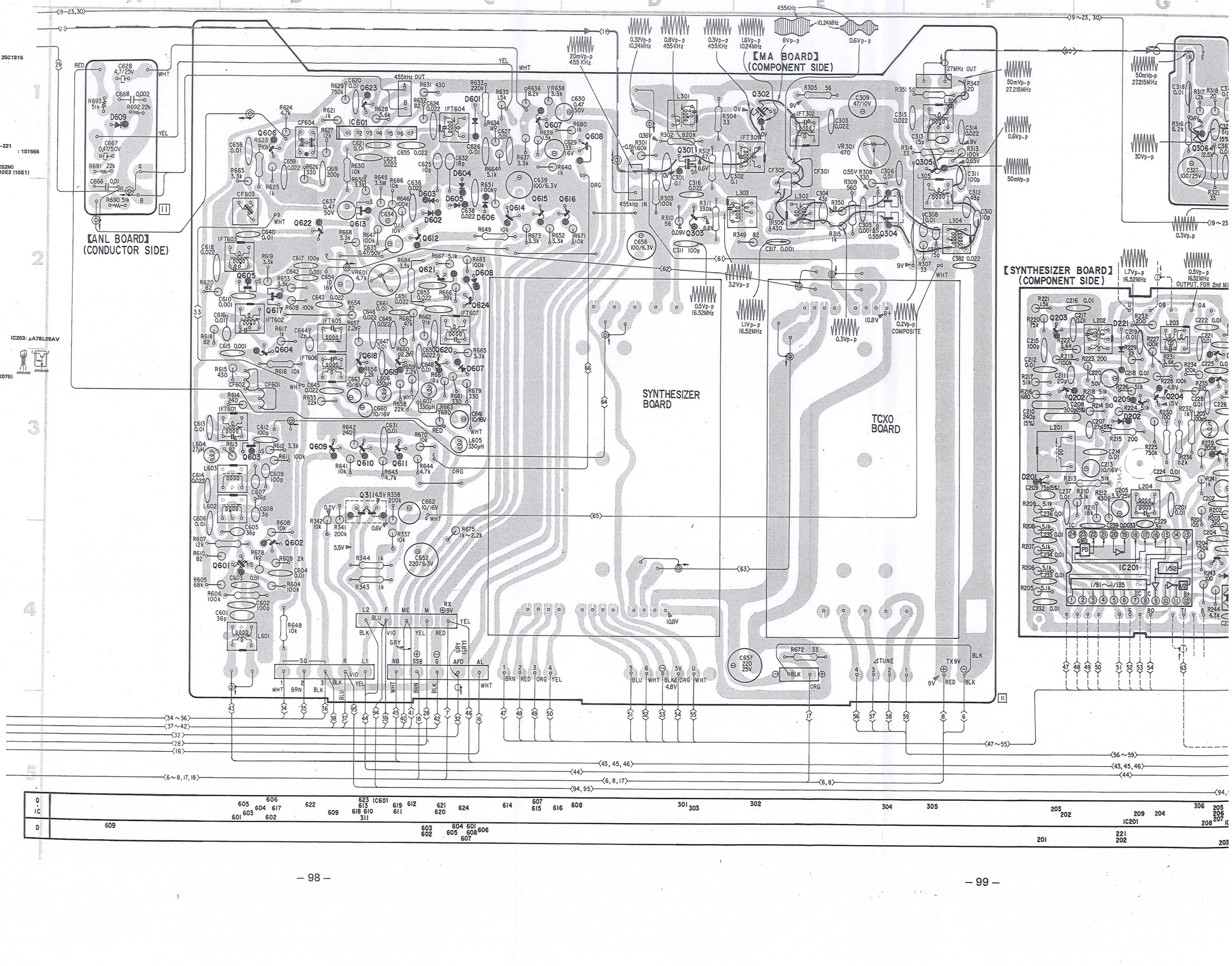
Q304: 2SK58

Note:

- Color code of sleeving over the end of the jacket.

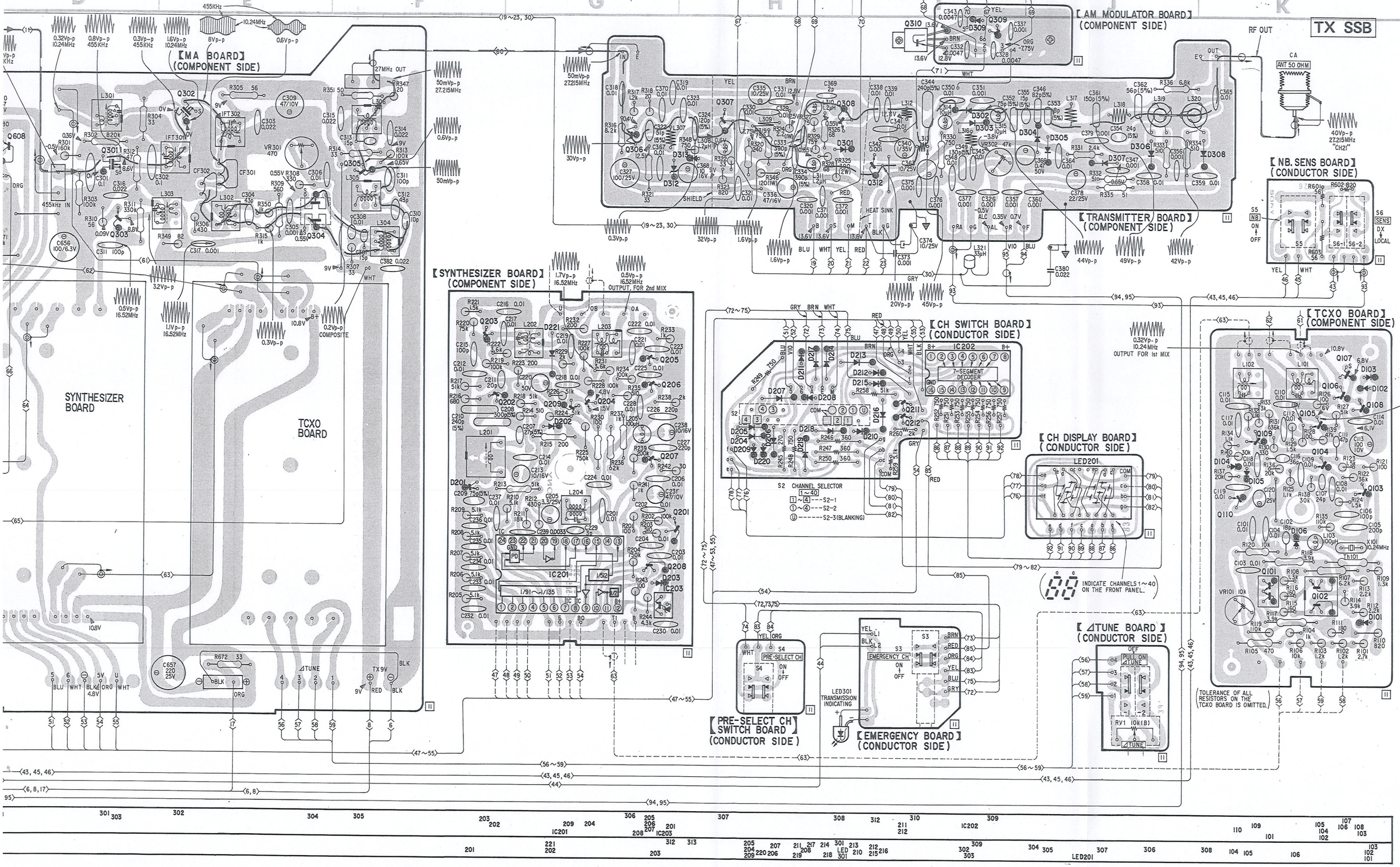


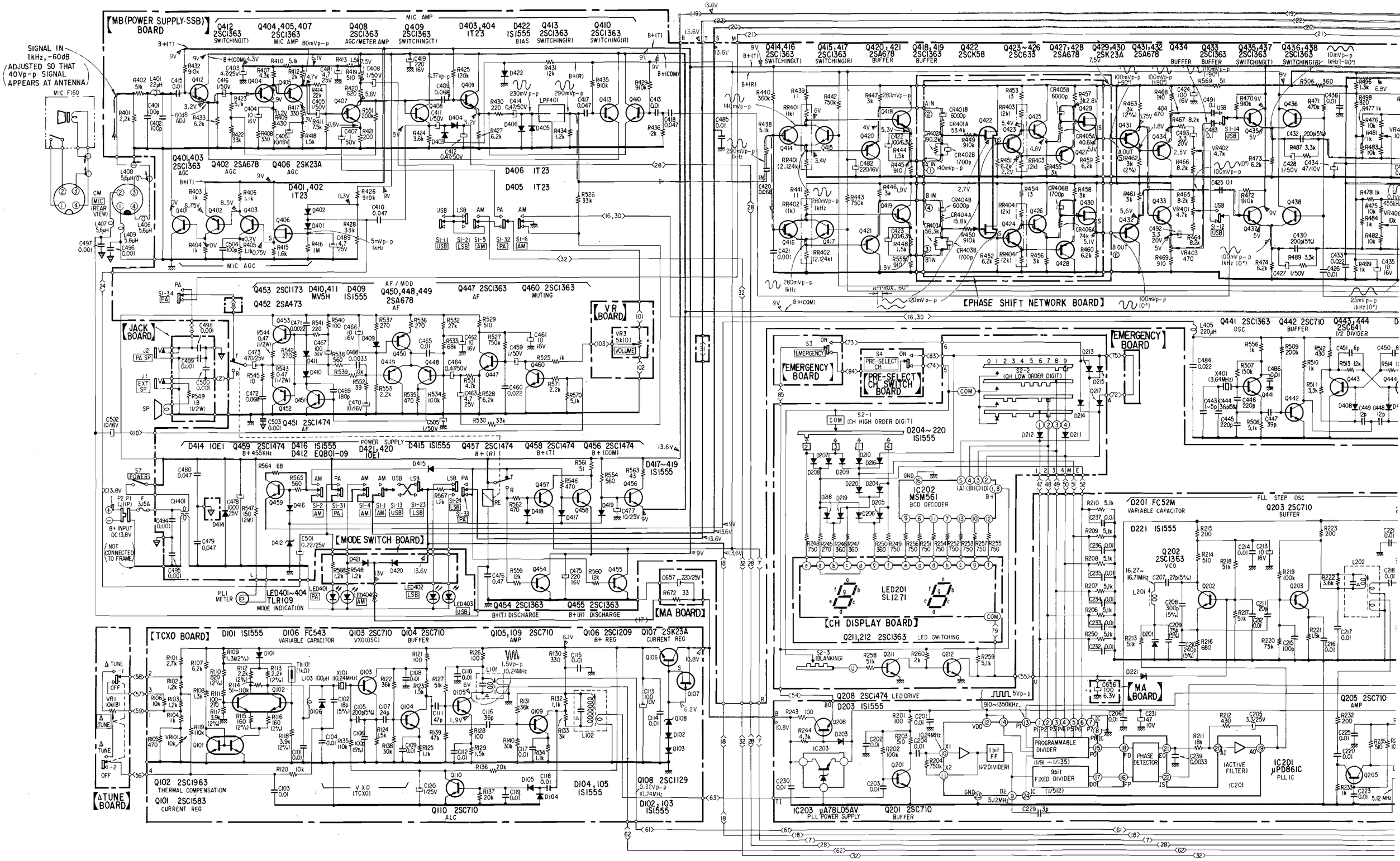
- : indicates side identified with part number.
- : B+ pattern
- : signal path

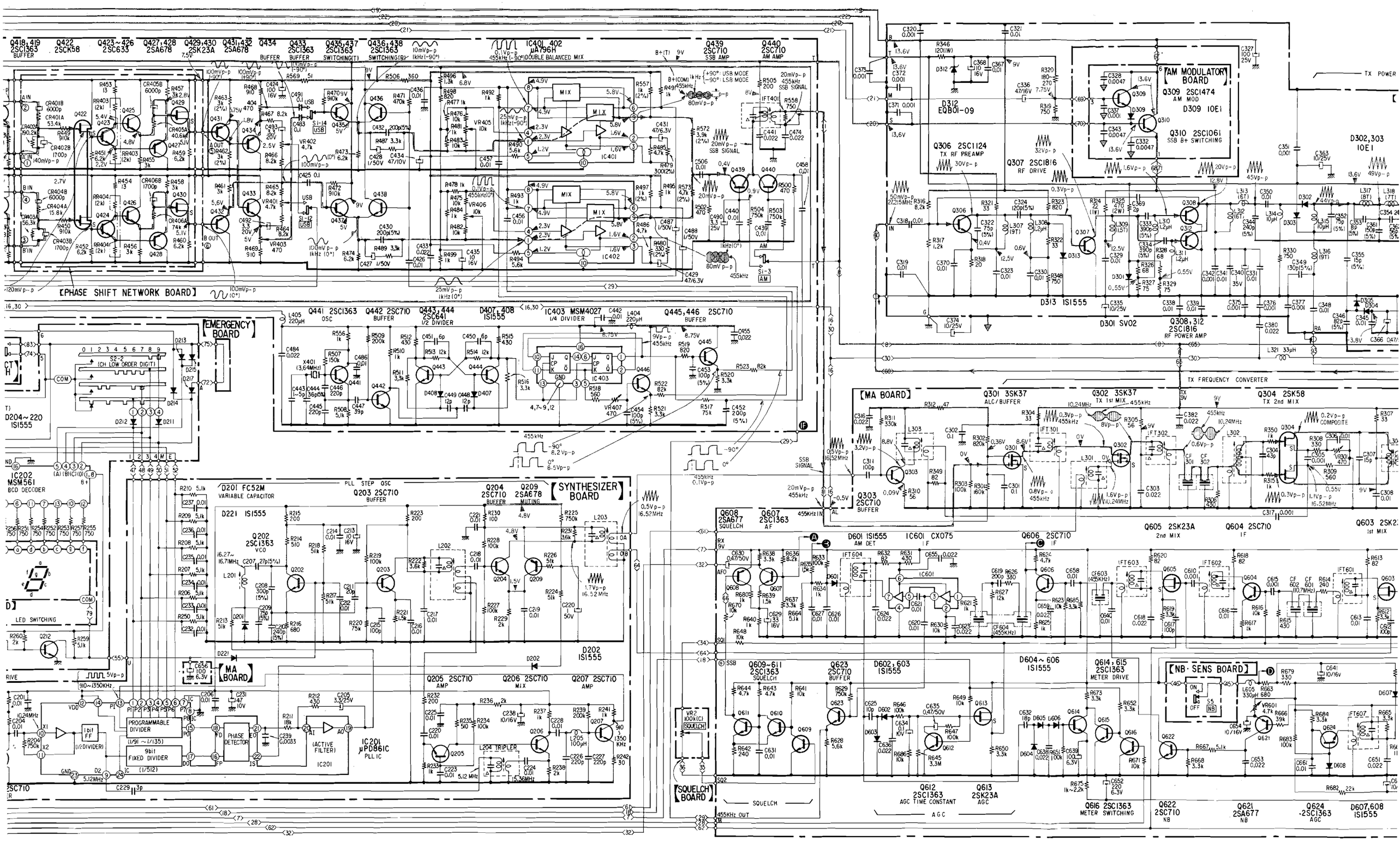


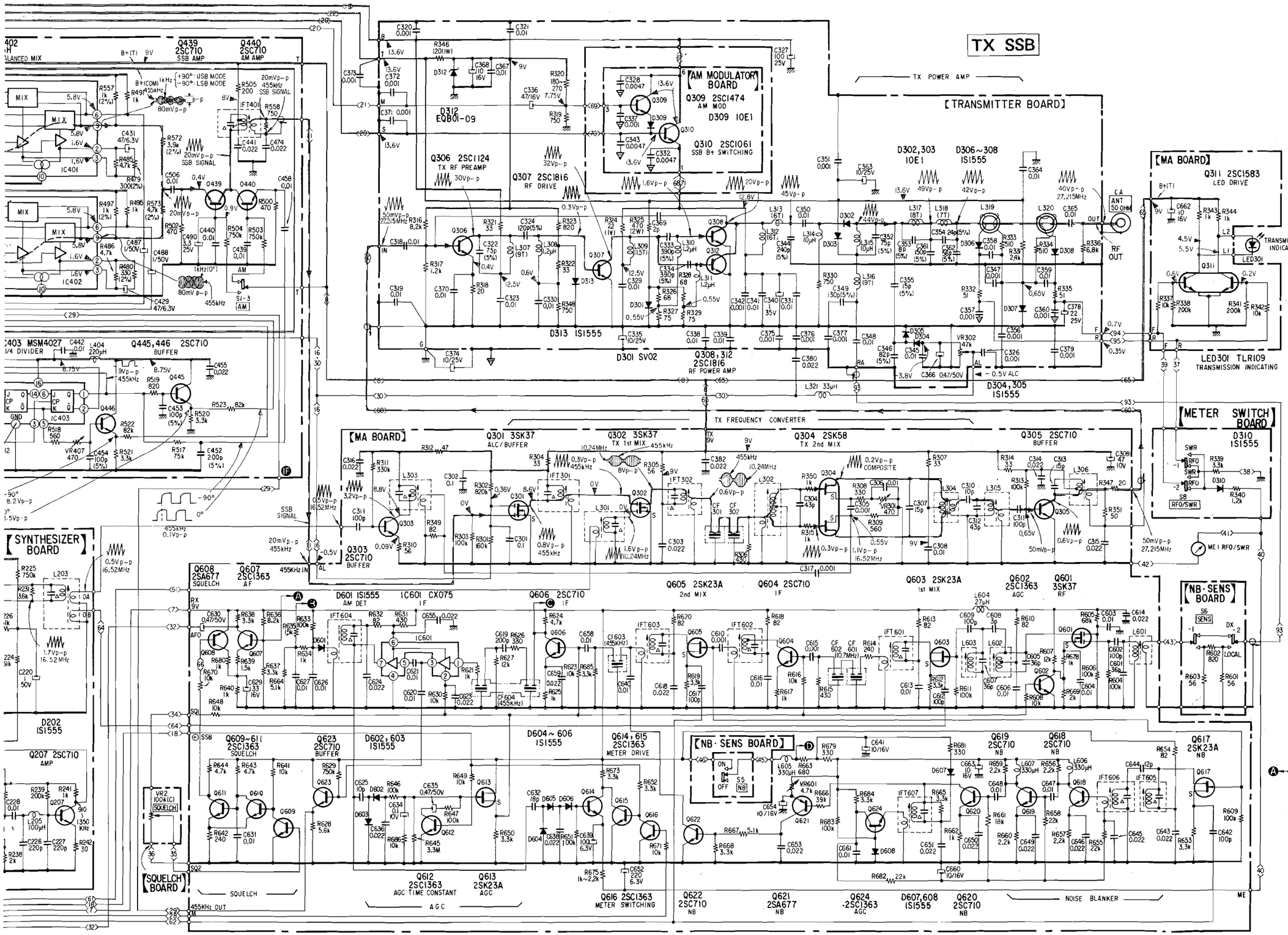
(9~23,30) (1) (29) (11) (20) (80) (19~23, 30) (60) (33) (66) (64) (65) (63) (6) (62) (19~23)

| | | |


TX SSB
【MA BOARD】
(COMPONENT SIDE)
SYNTHESIZER BOARD
TCXO BOARD
【SYNTHESIZER BOARD】
(COMPONENT SIDE)
【AM MODULATOR BOARD】
(COMPONENT SIDE)
【TRANSMITTER BOARD】
(COMPONENT SIDE)
【NB. SENS BOARD】
(CONDUCTOR SIDE)
【CH SWITCH BOARD】
(CONDUCTOR SIDE)
【CH DISPLAY BOARD】
(CONDUCTOR SIDE)
【TCXO BOARD】
(COMPONENT SIDE)
【PRE-SELECT CH】
SWITCH BOARD
(CONDUCTOR SIDE)
【EMERGENCY BOARD】
(CONDUCTOR SIDE)
【⊿TUNE BOARD】
(CONDUCTOR SIDE)
S2 CHANNEL SELECTOR
1 ~ 40
S2-1
S2-2
S2-3(BLANKING)
INDICATE CHANNELS 1 ~ 40 ON THE FRONT PANEL.
TOLERANCE OF ALL RESISTORS ON THE TCXO BOARD IS OMITTED.
RF OUT
ANT 50 OHM
455KHz
10.24MHz
27MHz OUT
455KHz IN
OUTPUT, FOR 2nd MIX
OUTPUT FOR 1st MIX
COMPOSITE
PRE-SELECT CH
EMERGENCY CH
LED301 TRANSMISSION INDICATING
7-SEGMENT DECODER
HEAT SINK
SHIELD


[MB (POWER SUPPLY·SSB) BOARD]
SIGNAL IN 1kHz, -60dB (ADJUSTED SO THAT 40Vp-p SIGNAL APPEARS AT ANTENNA)
MIC F160
CM MIC (REAR VIEW)
MIC AMP
Q412 2SC1363 SWITCHING(T)
Q404,405,407 2SC1363 MIC AMP
Q408 2SC1363 AGC/METER AMP
Q409 2SC1363 SWITCHING(T)
D403,404 1T23
D422 1S1555 BIAS
Q413 2SC1363 SWITCHING(R)
Q410 2SC1363 SWITCHING(R)
Q401,403 2SC1363 AGC
Q402 2SA678 AGC
Q406 2SK23A AGC
D401,402 1T23
D406 1T23
D405 1T23
MIC AGC
Q453 2SC1173 D410,411 MV5H D409 1S1555
Q452 2SA473
AF / MOD
Q450,448,449 2SA678 AF
Q447 2SC1363 AF
Q460 2SC1363 MUTING
[VR BOARD]
VR3 5k(D) VOLUME
[JACK BOARD]
PA SP
EXT SP
SP
Q451 2SC1474 AF
POWER SUPPLY
D414 1OE1 Q459 2SC1474 B+ 455KHz
D416 1S1555
D412 EQB01-09
D42L,420 1OE1
D415 1S1555
Q457 2SC1474 B+(R)
Q458 2SC1474 B+(T)
Q456 2SC1474 B+(COM)
D417~419 1S1555
[MODE SWITCH BOARD]
S7 POWER
DC13.8V
B+ INPUT DC13.8V
(NOT CONNECTED TO FRAME)
CH401
PLL METER
LED401~404 TLR109 MODE INDICATION
Q454 2SC1363 B+(T) DISCHARGE
Q455 2SC1363 B+(R) DISCHARGE
[MA BOARD]
[TCXO BOARD]
D101 1S1555 VARIABLE CAPACITOR
Q103 2SC710 VXO(OSC) BUFFER
Q104 2SC710 AMP
Q105,109 2SC710 B+ REG
Q106 2SC1209 CURRENT REG
Q107 2SK23A
Q102 2SC1963 THERMAL COMPENSATION
Q101 2SC1583 CURRENT REG
V.X.O (TCXO)
Q110 2SC710 ALC
D104,105 1S1555
Q108 2SC1129 0.32Vp-p 10.24MHz
D102,103 1S1555
[ΔTUNE BOARD]
ΔTUNE
VR1 10k(B)
S1-2
[PHASE SHIFT NETWORK BOARD]
Q414,416 2SC1363 SWITCHING(T)
Q415,417 2SC1363 SWITCHING(R)
Q420,421 2SA678 BUFFER
Q418,419 2SC1363 BUFFER
Q422 2SCK58
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A 2SA678
Q431,432 2SA678 BUFFER
Q434 2SC1363 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
[EMERGENCY BOARD]
S3 EMERGENCY
S4 PRE-SELECT CH
[PRE-SELECT CH SWITCH BOARD]
S2-2 (CH LOW ORDER DIGIT)
S2-1 (CH HIGH ORDER DIGIT)
D204~220 1S1555
IC202 MSM561 BCD DECODER
[CH DISPLAY BOARD]
LED201 SL1271
Q211,212 2SC1363 LED SWITCHING
Q208 2SC1474 LED DRIVE
D203 1S1555
IC203 μA78L05AV PLL POWER SUPPLY
Q201 2SC710 BUFFER
Q441 2SC1363
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
X401 (3.64MHz)
D201 FC52M VARIABLE CAPACITOR
PLL STEP OSC
Q203 2SC710 BUFFER
D221 1S1555
Q202 2SC1363 VCO
[MA BOARD]
Q205 2SC710 AMP
IC201 μPD861C PLL IC
1 bit FF (1/2 DIVIDER)
PROGRAMMABLE DIVIDER (1/91 ~ 1/135)
9bit FIXED DIVIDER (1/512)
PHASE DETECTOR
(ACTIVE FILTER)
IC201


Q418,419 2SC1363 BUFFER
Q422 2SC458
Q423~426 2SC633
Q427,428 2SA678
Q429,430 2SK23A
Q431,432 2SA678
Q434 BUFFER
Q433 2SC1363 BUFFER
Q435,437 2SC1363 SWITCHING(T)
Q436,438 2SC1363 SWITCHING(R)
IC401,402 μPA796H DOUBLE BALANCED MIX
Q439 2SC710 SSB AMP
Q440 2SC710 AM AMP
[PHASE SHIFT NETWORK BOARD]
[EMERGENCY BOARD]
Q441 2SC1363 OSC
Q442 2SC710 BUFFER
Q443,444 2SC641 1/2 DIVIDER
D407,408 1S1555
IC403 MSM4027 1/4 DIVIDER
Q445,446 2SC710 BUFFER
X401 (3.64MHz)
D204~220 1S1555
IC202 MSM5612 BCD DECODER
LED SWITCHING
[SYNTHESIZER BOARD]
PLL STEP QSC
D201 FC52M VARIABLE CAPACITOR
Q203 2SC710 BUFFER
Q204 2SC710 BUFFER
Q209 2SA678 MUTING
D221 1S1555
Q202 2SC1363 VCO
D222 1S1555
D202 1S1555
[MA BOARD]
Q205 2SC710 AMP
Q206 2SC710 MIX
Q207 2SC710 AMP
IC201 μPD861C PLL IC
PROGRAMMABLE DIVIDER
9bit FIXED DIVIDER
PHASE DETECTOR
1bit FF
(ACTIVE FILTER)
L204 TRIPLER
[AM MODULATOR BOARD]
Q309 2SC1474 AM MOD
D309 10E1
Q310 2SC1061 SSB B+ SWITCHING
D312 EQB01-09
Q306 2SC1124 TX RF PREAMP
Q307 2SC1816 RF DRIVE
D313 1S1555
D301 SV02
Q308,312 2SC1816 RF POWER AMP
D302,303 10E1
TX POWER
TX FREQUENCY CONVERTER
[MA BOARD]
Q301 3SK37 ALC/BUFFER
Q302 3SK37 TX 1st MIX
Q304 2SK58 TX 2nd MIX
Q303 2SC710 BUFFER
Q605 2SK23A 2nd MIX
Q604 2SC710 IF
Q603 2SK23 1st MIX
Q608 2SA677 SQUELCH
Q607 2SC1363 AF
D601 1S1555 AM DET
IC601 CX075 IF
Q606 2SC710 IF
[SQUELCH BOARD]
Q609~611 2SC1363 SQUELCH
Q623 2SC710 BUFFER
D602,603 1S1555
D604~606 1S1555
Q614,615 2SC1363 METER DRIVE
[NB·SENS BOARD]
Q612 2SC1363 AGC TIME CONSTANT
Q613 2SK23A AGC
Q616 2SC1363 METER SWITCHING
Q622 2SC710 NB
Q621 2SA677 NB
Q624 2SC1363 AGC
D607,608 1S1555
SQUELCH
AGC



Note:

- All capacitors are in μF unless otherwise noted. pF = μμF
  50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, 1/4W (5%) unless otherwise noted.
  kΩ = 1000Ω, MΩ = 1000 kΩ
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- 2% indicates component tolerance.
- △ : internal component
- ▬ : B+ bus.
- ▭ : panel designation
- ⏚ : direct connection to chassis.
- ⊖ : connected to ⊖ terminal of car battery.
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	MODE	LSB,
S2	CHANNEL SELECTOR	21
S3	EMERGENCY CH	OFF
S4	PRE-SELECT CH	OFF
S5	NB	OFF
S6	SENS	DX
S7	POWER	OFF
S8	RFO/SWR	RFO

- RX : Receiving
- TX : Transmitting
- B+ supply : 13.8 V
- Current drain
  1.2A ... antenna load 50Ω (1 kHz, approx. −60dB signal is applied at microphone input and 40 Vp-p signal appears at antenna.)
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a VOM (20 kΩ/V).
- Signal waveforms are taken under the following condition.
  Mode : TX LSB or TX USB, S6 (SENS) at DX and Δ tune is off.
  Channel : 21
- Frequency of 455 kHz SSB signal is SSB GENERATOR section is accurately 454 kHz in TX LSB mode and 456 kHz in TX USB mode.

• Abbreviation

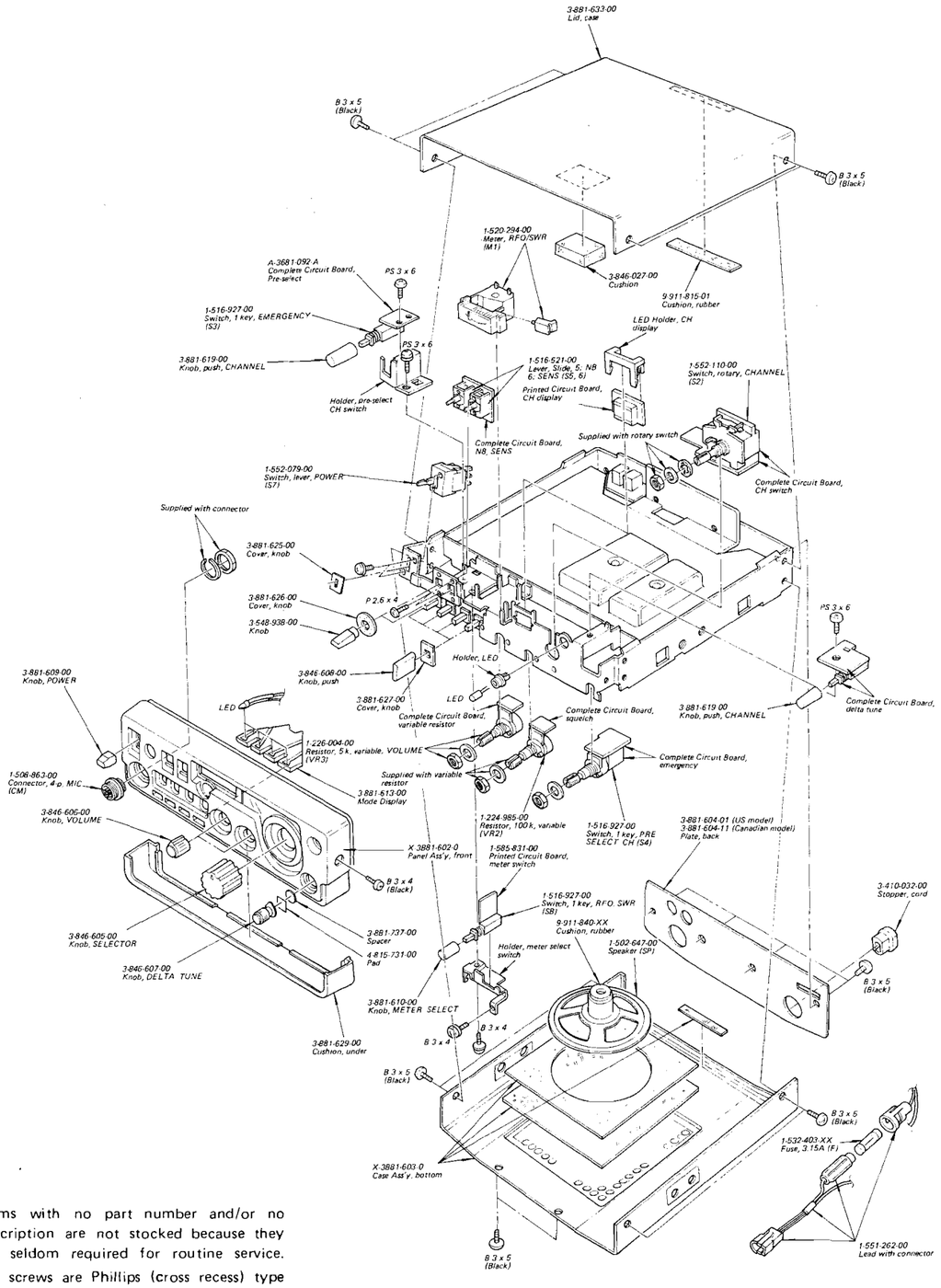
ALC ..... Automatic Level Control
BCD ..... Binary Coded Decimal
NB ..... Noise Blanker
PLL ..... Phase-locked Loop
PSN ..... Phase Shift Network
R or RX .. Receiving
T or TX .. Transmitting
TCXO .... Thermal Compensated Crystal Oscillator
VXO ..... Variable Crystal Oscillator
Δ Tune .. Delta Tune

ICB-2500

SECTION 5

EXPLODED VIEWS

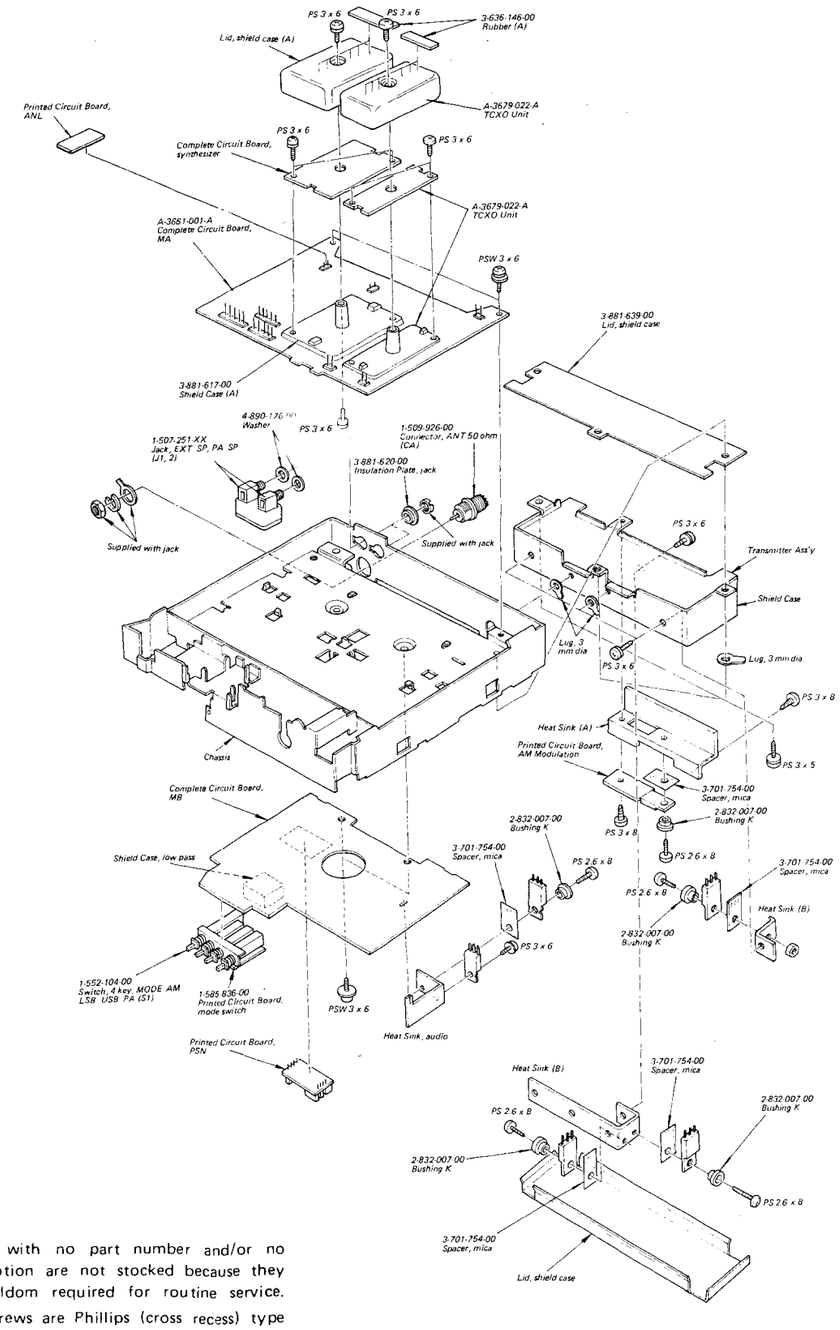
5-1



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

5-2.

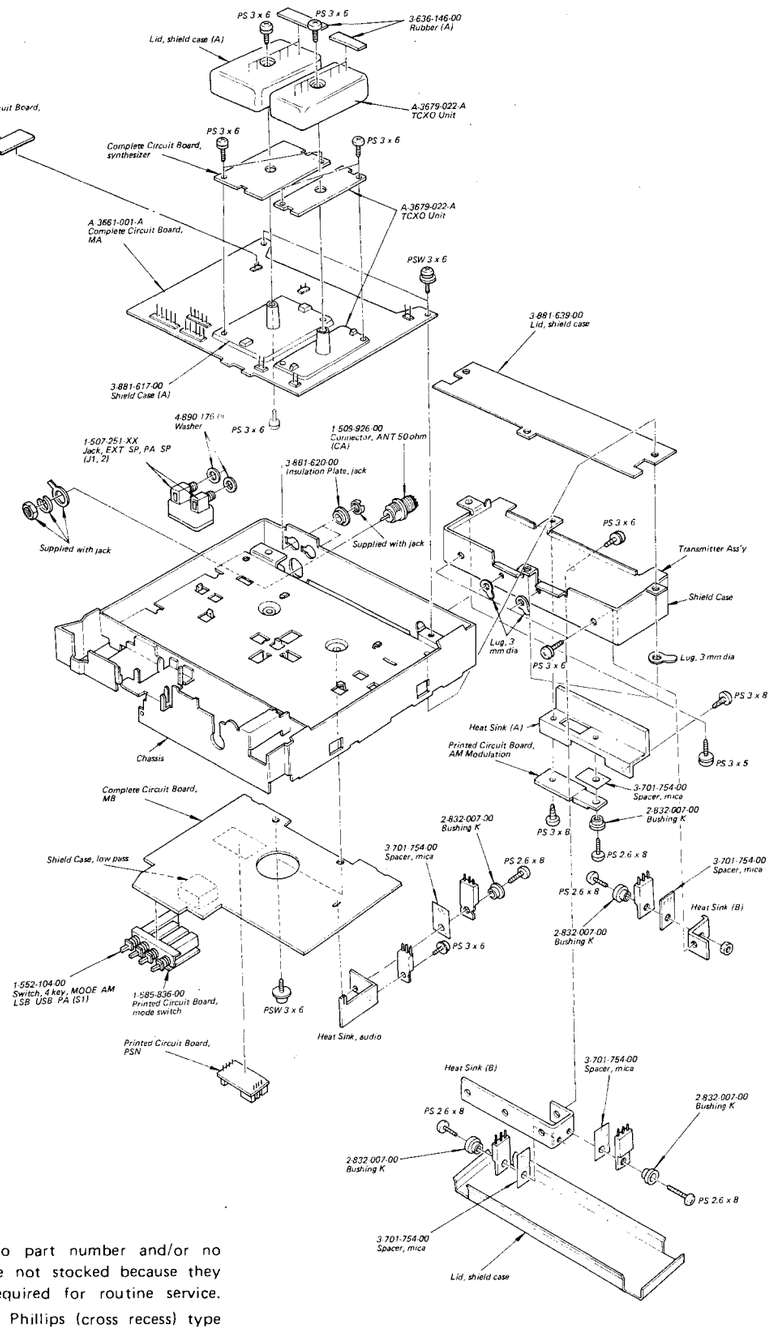


Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

A | B | C | D

5-2.



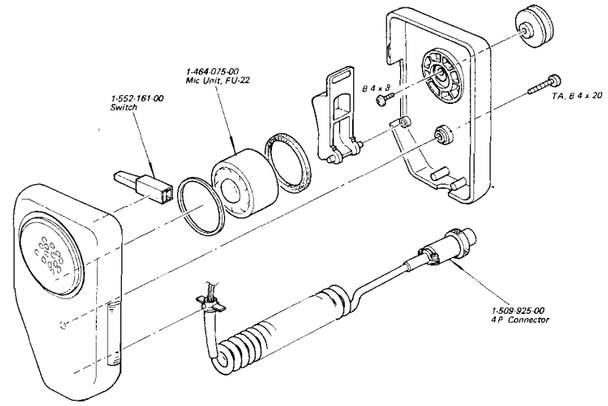
Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

A | B | C | D

5-3. **MICROPHONE**

8-811-251-00
Microphone, F-160



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.

Ref. No.

Q104, 105
Q109, 110

Q201
⇒Q202
Q203 – 207
Q208
Q209

⇒Q211, 212
Q301, 302
Q303
Q304
Q305

Q306
Q307, 308
Q309
Q310
Q311
Q312

⇒Q401
⇒Q402
⇒Q403 – 40
⇒Q406
⇒Q407 – 41

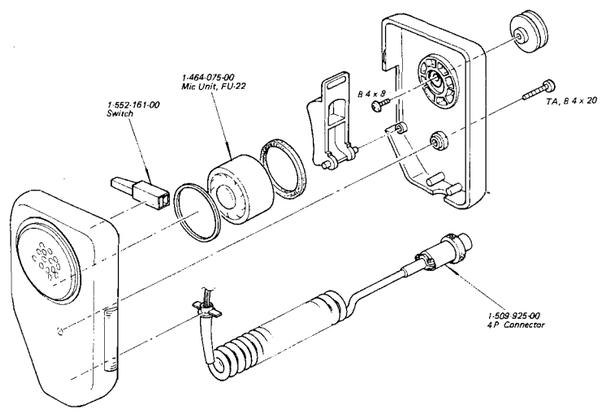
⇒Q412 – 41
Q420, 421
Q422
⇒Q423 – 42
Q427, 428

⇒Q429, 430
Q431, 432
⇒Q433
Q434

D A B C D

5-3. MICROPHONE

8-811-251-00
Microphone, F-160



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.

SECTION 6
ELECTRICAL PARTS LIST

Ref. No.	*Part No.*	*Description*
		CIRCUIT BOARDS
	A-3661-001-A	Complete Circuit Board, MA
	A-3681-092-A	Complete Circuit Board, Pre-Select
	1-585-831-00	Printed Circuit Board, meter switch
	1-585-836-00	Printed Circuit Board, mode switch
		SEMICONDUCTORS
		Transistors
Q104, 105		2SC710
Q109, 110		2SC710
Q201		2SC710
⇒Q202		2SC634A
Q203 – 207		2SC710
Q208		2SC1474
Q209		2SA678
⇒Q211, 212		2SC634A
Q301, 302		3SK37
Q303		2SC710
Q304		2SK58
Q305		2SC710
Q306		2SC1124
Q307, 308		2SC1816
Q309		2SC1474
Q310		2SC1061
Q311		2SC1583
Q312		2SC1816
⇒Q401		2SC634A
⇒Q402		2SA678
⇒Q403 – 405		2SC634A
⇒Q406		2SK23A-824
⇒Q407 – 410		2SC634A
⇒Q412 – 419		2SC634A
Q420, 421		2SA678
Q422		2SK58
⇒Q423 – 426		2SC634A
Q427, 428		2SA678
⇒Q429, 430		2SK23A-812
Q431, 432		2SA678
⇒Q433		2SC634A
Q434		2SA678
⇒Q435 – 438		2SC634A
Q439, 440		2SC710
⇒Q441		2SC634A
Q442		2SC710
⇒Q443, 444		2SC641K
Q445, 446		2SC710
⇒Q447		2SC634A
Q448 – 450		2SA678
Q451		2SC1474
Q452		2SA473
Q453		2SC1173
⇒Q454, 455		2SC634A
Q456 – 459		2SC1474
⇒Q460		2SC634A
Q601		3SK37
⇒Q602		2SC634A
⇒Q603		2SK23A-824
Q604		2SC710
⇒Q605		2SK23A-824
Q606		2SC710
⇒Q607		2SC634A
Q608		2SA678
⇒Q609 – 612		2SC634A
⇒Q613		2SK23A-860
⇒Q614 – 616		2SC634A
⇒Q617		2SK23A-824
Q618 – 620		2SC710
Q621		2SA678
Q622, 623		2SC710
⇒Q624		2SC634A
		ICs
IC201		μPD861C
IC202		MSM561
IC203		μA78L05AV
IC401, 402		μA796HC
IC403		MSM4027
⇒IC601		CX075B

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Ref. No.	Part No.	Description
		Diodes
D102, 103		1S1555
D104, 105		1S1555
⇒D201		FC52C
D202 – 221		1S1555
D301		SV02
⇒D302, 303		10E2
D304 – 308		1S1555
⇒D309		10E2
D310		1S1555
D312		EQB01-09
D313		1S1555
⇒D401 – 406		1T22A
D407 – 409		1S1555
⇒D410, 411		VD1120
D412		EQB01-09
⇒D414		10E2
D415 – 419		1S1555
⇒D420, 421		10E2
D422		1S1555
D601 – 609		1S1555
LED201		SL1272
LED301		TLR109
LED401 – 404		TLR109
		COILS
L201	1-405-754-00	Osc
L202, 203	1-425-947-00	Output
L204	1-425-946-00	Tripler Transformer
L205	1-407-169-XX	100 μH, microinductor
L301	1-425-936-00	Output, 10.7 MHz
L302	1-425-955-00	Coil, 10.7 MHz
L303	1-425-947-00	Output, 16 MHz
L304	1-425-954-00	Coil, 27 MHz
L305	1-425-953-00	Coil, 27 MHz
L306	1-425-961-00	Coil, 27 MHz
L308, 310, L311	1-407-179-00	Microinductor, 1.2 μH
L314, 315	1-407-157-XX	10 μH, microinductor
L321	1-407-163-XX	33 μH, microinductor

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Ref. No.	Part No.	Description
L401	1-407-161-XX	22 μH, microinductor
L404, 405	1-407-173-XX	220 μH, microinductor
L406 ~ 409	1-407-187-XX	5.6 μH, microinductor
L601	1-401-690-00	Antenna
L602, 603	1-425-948-00	RF, 27 MHz
L604	1-407-162-XX	27 μH, microinductor
L605 ~ 607	1-407-175-XX	330 μH, microinductor
		TRANSFORMERS
IFT301	1-404-023-00	IFT, 27 MHz
IFT302	1-404-031-00	IFT, 10.7 MHz
IFT401	1-403-152-00	IFT, AM
IFT601	1-404-031-00	IFT, 10.7 MHz
IFT602	1-403-868-00	IFT, 10.7 MHz
IFT603	1-404-023-00	IFT, 27 MHz
IFT604	1-403-161-00	IFT, 455 kHz
IFT605 - 607	1-404-023-00	IFT, 27 MHz
CF301, 302 CF601, 602	1-527-184-XX	Ceramic Filter, 10.7 MHz
CF603, 604	1-527-290-11	Ceramic Filter, 455 kHz

CAPACITORS

All capacitors are in μF and ceramic unless otherwise noted.
50WV or less are not indicated except for electrolytics.
pF = μμF, elect = electrolytic

C201	1-161-070-11	0.01		(boundary layer)
C202 – 204	1-101-004-11	0.01		
C205	1-131-206-11	3.3	25 V	(boundary layer)
C206	1-101-004-11	0.01		
C207	1-102-883-11	27 p		
C208	1-107-096-11	300 p		silvered mica
C209	1-102-761-11	75 p		
C210	1-107-094-11	240 p		silvered mica
C211	1-102-958-11	20 p		
C212	1-101-004-11	0.01		
C213	1-121-651-11	10	16 V	elect
C214	1-101-004-11	0.01		

Ref. No.	Part No.	Description		
C215	1-102-973-11	100 p		
C216 – 218	1-101-004-11	0.01		
C219	1-161-070-11	0.01		(boundary layer)
C220	1-121-391-11	1	50 V	elect
C221 – 225	1-101-004-11	0.01		
C226, 227	1-102-978-11	220		
C228	1-101-004-11	0.01		
C229	1-102-936-11	3 p		
C230	1-101-004-11	0.01		
C231	1-121-352-11	47	10 V	elect
C232 – 237	1-101-004-11	0.01		
C238	1-121-651-11	10	16 V	elect
C239	1-161-007-11	0.0033	25 V	(boundary layer)
C301, 302	1-161-076-11	0.1		(boundary layer)
C303	1-161-034-11	0.022		(boundary layer)
C304	1-102-674-11	43 p		
C305	1-161-026-11	0.001		(boundary layer)
C306	1-101-004-11	0.01		
C307	1-102-668-11	15 p		
C308	1-161-032-11	0.01		(boundary layer)
C309	1-121-352-11	47	10 V	elect
C310	1-102-858-11	10 p		
C311	1-102-973-11	100 p		
C312	1-102-674-11	43 p		
C313	1-102-668-11	15 p		
C314, 315	1-161-034-11	0.022		(boundary layer)
C316	1-101-005-11	0.022		
C317	1-101-001-11	0.001		
C318, 319	1-161-070-11	0.01		(boundary layer)
C320	1-161-026-11	0.001		
C321	1-161-070-11	0.01		(boundary layer)
C322	1-101-882-11	51 p		silvered mica
C323	1-161-070-11	0.01		(boundary layer)
C324	1-102-816-11	120 p		
C326	1-161-026-11	0.001		
C327	1-121-965-11	100	25 V	elect
C328	1-161-068-11	0.0047		
C329 – 331	1-161-070-11	0.01		(boundary layer)

Ref. No.	Part No.	Description		
C332	1-161-068-11	0.0047		
C333, 334	1-102-822-11	390 p		
C335	1-131-238-11	10	25 V	tantalum
C336	1-121-970-11	47	16 V	elect
C337	1-161-064-11	0.001		
C338, 339	1-161-070-11	0.01		(boundary layer)
C340	1-131-215-11	1	35 V	tantalum
C341	1-161-070-11	0.01		(boundary layer)
C342	1-161-026-11	0.001		
C343	1-161-068-11	0.0047		
C344	1-107-094-11	240		silvered mica
C345	1-161-070-11	0.01		(boundary layer)
C346	1-107-083-11	82 p		silvered mica
C347	1-161-026-11	0.001		
C348	1-161-070-11	0.01		(boundary layer)
C349	1-107-088-11	130 p		silvered mica
C350	1-161-070-11	0.01		(boundary layer)
C352	1-101-882-11	75 p		
C353	1-102-945-11	8 p		silvered mica
C354	1-101-982-51	24 p		silvered mica
C355	1-107-065-11	15 p		silvered mica
C356, 357	1-161-026-11	0.001		
C358, 359	1-161-070-11	0.01		(boundary layer)
C360	1-161-026-11	0.001		
C361	1-107-089-11	150		silvered mica
C362	1-107-079-11	56 p		silvered mica
C363	1-121-398-11	10	25 V	elect
C364, 365	1-161-070-11	0.01		(boundary layer)
C366	1-121-951-11	0.47	50 V	elect
C367	1-161-070-11	0.01		(boundary layer)
C368	1-121-968-11	10	16 V	elect
C369	1-102-935-11	2 p		
C370	1-161-070-11	0.01		(boundary layer)
C371 – 373	1-161-026-11	0.001		
C374	1-121-398-11	10	25 V	elect
C375 – 377	1-101-001-11	0.001		
C378	1-121-490-11	22	25 V	elect
C379	1-161-026-11	0.001		

Ref. No.	Part No.	Description		
C380	1-101-005-11	0.022		
C382	1-161-034-11	0.022		(boundary layer)
C401, 402	1-102-973-11	100 p		
C403	1-121-395-11	4.7	25 V	elect
C404	1-121-651-11	10	16 V	elect
C405	1-121-391-11	1	50 V	elect
C406	1-121-651-11	10	16 V	elect
C407, 408	1-121-391-11	1	50 V	elect
C409	1-108-249-12	0.068		mylar
C410	1-108-246-12	0.047		mylar
C411	1-108-391-11	1	50 V	elect
C412	1-121-726-11	0.47	50 V	elect
C413	1-108-239-12	0.01		mylar
C414	1-121-726-11	0.47	50 V	elect
C415	1-108-239-12	0.01		mylar
C416	1-121-391-11	1	50 V	elect
C417, 418	1-108-246-12	0.047		mylar
C419	1-123-068-11	220	16 V	elect
C420	1-108-249-12	0.068		mylar
C421	1-108-227-12	0.001		mylar
C422, 423	1-121-414-11	100	6.3 V	elect
C424	1-121-415-11	100	16 V	elect
C425	1-108-251-12	0.1		mylar
C426	1-101-004-11	0.01		
C427, 428	1-121-391-11	1	50 V	elect
C429	1-121-723-11	47	6.3 V	elect
C430	1-107-092-11	200		silvered mica
C431	1-121-723-11	47	6.3 V	elect
C432	1-107-092-11	200		silvered mica
C433	1-101-005-11	0.022		
C434	1-121-352-11	47	10 V	elect
C435	1-121-651-11	10	16 V	elect
C436	1-101-004-11	0.01		
C439, 440	1-101-004-11	0.01		
C441	1-101-005-11	0.022		
C442	1-101-004-11	0.01		
C443	1-102-934-11	1 p		
	1-102-935-11	2 p		
	1-102-936-11	3 p		

Ref. No.	Part No.	Description		
C443	1-102-937-11	4 p		
	1-102-942-11	5 p		
C444	1-107-074-11	36 p		silvered mica
C445, 446	1-107-093-11	220 p		silvered mica
C447	1-102-965-11	39 p		
C448, 449	1-102-949-11	12 p		
C450, 451	1-102-943-11	6 p		
C452	1-102-977-11	220 p		
C453, 454	1-107-085-11	100 p		silvered mica
C455	1-101-005-11	0.022		
C456 – 458	1-101-004-11	0.01		
C459	1-121-391-11	1	50 V	elect
C460	1-108-242-12	0.022		mylar
C461, 462	1-121-651-11	10	16 V	elect
C463	1-121-395-11	4.7	25 V	elect
C464	1-121-726-11	0.47	50 V	elect
C465	1-108-239-12	0.01		mylar
C466	1-121-651-11	10	16 V	elect
C467	1-121-415-11	100	16 V	elect
C468	1-108-232-12	0.0033		mylar
C469	1-102-976-11	180 p		
C470	1-121-651-11	10	16 V	elect
C471	1-108-230-12	0.0022		mylar
C472	1-108-249-12	0.068		mylar
C473	1-121-940-11	470	25 V	elect
C474	1-101-005-11	0.022		
C475	1-123-068-11	220	16 V	elect
C476	1-105-689-12	0.47		mylar
C477	1-121-398-11	10	25 V	elect
C478	1-123-066-11	1000	25 V	elect
C479, 480	1-161-036-11	0.047		(boundary layer)
C481	1-121-395-11	4.7	25 V	elect
C482	1-123-068-11	220	16 V	elect
C483	1-108-251-12	0.1		mylar
C484	1-101-005-11	0.022		
C485	1-161-070-11	0.01		(boundary layer)
C486	1-101-004-11	0.01		
C487, 488	1-121-391-11	1	50 V	elect

Ref. No.	Part No.	Description		
C489	1-121-395-11	4.7	25 V	elect
C490	1-121-392-11	3.3	25 V	elect
C491	1-108-251-12	0.1		mylar
C492, 493	1-121-392-11	3.3	25 V	elect
C494, 495	1-101-001-11	0.001		
C496, 497	1-161-026-11	0.001		(boundary layer)
C498 – 500	1-101-001-11	0.001		
C501	1-131-211-11	0.22	25 V	tantalum
C502	1-121-651-11	10	16 V	elect
C503	1-108-227-12	0.001		mylar
C504	1-102-973-11	100 p		
C505	1-121-391-11	1	50 V	elect
C506	1-161-070-11	0.01		(boundary layer)
C601	1-102-890-11	36 p		
C602	1-102-973-11	100 p		
C603	1-101-004-11	0.01		
C604	1-161-032-11	0.01		(boundary layer)
C605	1-102-890-11	36 p		
C606	1-161-032-11	0.01		(boundary layer)
C607	1-102-890-11	36 p		
C608	1-102-661-11	3 p		
C609	1-102-973-11	100 p		
C610	1-101-001-11	0.001		
C612	1-102-973-11	100 p		
C613	1-101-004-11	0.01		
C614	1-101-005-11	0.022		
C615	1-101-001-11	0.001		
C616	1-161-032-11	0.01		(boundary layer)
C617	1-102-973-11	100 p		
C618	1-161-034-11	0.022		(boundary layer)
C619	1-102-977-11	220 p		
C620, 621	1-101-004-11	0.01		
C623	1-101-005-11	0.022		
C624	1-161-034-11	0.022		(boundary layer)
C625	1-102-858-11	10 p		
C626, 627	1-101-004-11	0.01		
C628	1-121-395-11	4.7	25 V	elect
C629	1-121-402-11	33	16 V	elect

Ref. No.	Part No.	Description		
C630	1-121-726-11	0.47	50 V	elect
C631	1-101-004-11	0.01		
C632	1-102-953-11	18 p		
C634	1-127-019-11	0.1	10 V	solid aluminum
C635	1-121-726-11	0.47	50 V	solid aluminum
C636	1-108-281-12	0.022		mylar
C638	1-161-034-11	0.022		(boundary layer)
C639	1-121-413-11	100	6.3 V	elect
C640	1-101-004-11	0.01		
C641	1-121-651-11	10	16 V	elect
C642		100 p		
C643	1-161-034-11	0.022		(boundary layer)
C644	1-102-666-11	12 p		
C645	1-101-005-11	0.022		
C646	1-161-034-11	0.022		(boundary layer)
C647, 648	1-101-004-11	0.01		
C649–651	1-161-034-11	0.022		(boundary layer)
C652	1-121-419-11	220	6.3 V	elect
C653	1-108-281-12	0.022		mylar
C654	1-121-651-11	10	16 V	elect
C655	1-101-005-11	0.022		
C656	1-121-413-11	100	6.3 V	elect
C657	1-121-422-11	220	25 V	elect
C658	1-161-070-11	0.01		
C659	1-161-034-11	0.022		(boundary layer)
C660	1-121-651-11	10	16 V	elect
C661	1-101-004-11	0.01		
C663	1-121-469-11	10	10 V	elect
C666	1-101-004-11	0.01		
C667	1-121-726-11	0.47	50 V	elect
C668	1-101-005-11	0.022		
C683	1-161-034-11	0.022		(boundary layer)

RESISTORS

All resistors are in ohms. Common ¼W carbon resistors are omitted. Check schematic diagram for values.

R324	1-212-364-11	2.2	1 W	metal oxide
R325	1-206-654-11	390	2 W	metal oxide
R346	1-213-132-11	120	1 W	metal oxide
RR401,402	1-231-324-11	1 k, 2.124 k, Encapsulated Component		
RR403,404	1-231-317-11	2 k, 2 k, Encapsulated Component		

Ref. No.	*Part No.*	*Description*		
R479	1-214-371-11	300	¼ W (2%)	metal oxide
R480	1-214-372-11	330	¼ W (2%)	metal oxide
R543, 544	1-207-616-11	0.47	½ W	wirewound
R547	1-206-642-11	150	2 W	wirewound
R549	1-206-466-11	1.8	½ W	wirewound
VR1	1-224-984-00	10 k, variable		
VR2	1-224-985-00	100 k, variable; SQUELCH		
VR3	1-226-004-00	5 k, variable; VOLUME		
VR301	1-224-248-XX	470		adjustable
VR302	1-224-425-00	47 k		adjustable
VR401, 402	1-224-251-XX	4.7 k		adjustable
VR403, 404	1-224-248-XX	470		adjustable
VR405, 406	1-224-252-XX	10 k		adjustable
VR407	1-224-248-00	470		adjustable
VR601	1-224-251-XX	4.7 k		adjustable

SWITCHES

S1	1-552-104-00	4 key, MODE; AM LSB USB PA
S2	1-552-110-00	Rotary, CHANNEL
S3	1-516-927-00	1 key, EMERGENCY
S4	1-516-927-00	1 key, PRE SELECT CH
S5, 6	1-516-521-00	Lever Slide, 5: NB 6: SENS
S7	1-552-079-00	Lever, POWER
S8	1-516-927-00	1 key, RFO/SWR

MISCELLANEOUS

CA	1-509-926-00	Connector, ANT 50 ohm
CH401	1-441-855-00	Choke Coil
CM	1-508-863-00	Connector, 4-p; MIC
CR401A – 406A CR401B – 406B	9-831-024-11	Special Component; 12-piece kit

Ref. No.	*Part No.*	*Description*		
F	1-532-403-XX	Fuse, 3.15 A		
J1, 2	1-507-251-XX	Jack, EXT SP, PA SP		
L.F.P401	1-231-327-11	Low Pass Filter, AF		
M1	1-520-294-00	Meter, RFO/SWR		
	1-551-262-00	Lead with Connector		
RE	1-515-276-00	Relay		
SP	1-502-647-00	Speaker		
X101	1-527-276-11	X'tal	10.24 MHz	
X401	1-527-285-11	X'tal	3.64 MHz	
	1-535-118-21	5 p terminal with base		
	1-535-201-11	Through Pin		

MIC Section

MIC	8-811-251-00	Microphone, F-160
	1-464-075-00	Mic Unit, FU-22
	1-509-925-00	4 p connector
	1-552-161-00	Switch

TCXO Section

	A-3679-022-A	TCXO Unit		
Q104, 105		2SC710		
Q109, 110		2SC710		
D104, 105		1S1555		
L101, 102	1-425-936-11	Coil, output		
C107	1-107-070-11	24 pF		silvered mica
C109 – 110	1-102-129-11	0.01 μF		ceramic
C111	1-101-880-11	47 pF		ceramic
C112, 115	1-102-129-11	0.01 μF		ceramic
C116	1-102-964-11	36 pF		ceramic
C117 – 119	1-102-129-11	0.01 μF		ceramic
C120	1-131-236-11	1 μF	25 V	tantalum
	1-508-861-00	Connector, 5 p		
	1-508-862-00	Connector, 4 p		

ACCESSORIES & PACKING MATERIALS

Part No.	*Description*
A-3602-002-A	Accessories Ass'y
X-3881-601-0	FCC Ass'y (US model)
including;	
3-701-625-00	Bag, plastic
1-509-925-21	Connector, microphone
1-551-253-00	Lead with connector, power
3-701-618-00	Bag, plastic
3-881-640-01	Bracket
3-881-643-00	Cushion, lower

Part No.	*Description*	
3-881-644-00	Bag, protection	
3-881-645-00	Spacer	
3-881-646-00	Carton	
3-881-647-00	Cushion, upper	
3-993-149-21	FCC Part 95	(US model)
3-993-150-21	FCC Federal Register	(US model)
3-993-151-21	FCC Form 505	(US model)
3-993-152-21	FCC Form 555B	(US model)
3-995-769-22	Manual, instruction	(US model)
3-995-769-31	Manual, instruction	(Canadian model)

Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	26.965 MHz	15	27.135 MHz	29	27.295 MHz
2	26.975 MHz	16	27.155 MHz	30	27.305 MHz
3	26.985 MHz	17	27.165 MHz	31	27.315 MHz
4	27.005 MHz	18	27.175 MHz	32	27.325 MHz
5	27.015 MHz	19	27.185 MHz	33	27.335 MHz
6	27.025 MHz	20	27.205 MHz	34	27.345 MHz
7	27.035 MHz	21	27.215 MHz	35	27.355 MHz
8	27.055 MHz	22	27.225 MHz	36	27.365 MHz
9	27.065 MHz	23	27.255 MHz	37	27.375 MHz
10	27.075 MHz	24	27.235 MHz	38	27.385 MHz
11	27.085 MHz	25	27.245 MHz	39	27.395 MHz
12	27.105 MHz	26	27.265 MHz	40	27.405 MHz
13	27.115 MHz	27	27.275 MHz		
14	27.125 MHz	28	27.285 MHz		

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